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MY ANIMAL FRIENDS

My Animal Friends

By

C. EMERSON BROWN
C.M.Z.S.

ILLUSTRATED

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PREFACE

THIS book is written from the viewpoint of one who throughout a long and intimate experience with animals has sought always to be their friend and defender. The author has studied wild life in its native habitat and assumed the responsibility for its well-being under the more artificial, and sometimes difficult, conditions of captivity. Throughout his experience he has attempted to govern and to aid his charges, not by the force and the power which weapons and a more highly developed intelligence lend to man, but rather by winning the confidence of those whom he has grown to regard as his guests.

The book is not a natural history, although it hopes to contribute, from years of observation, its small part to the growing fund of knowledge concerning wild life. It is not a treatise on zoological gardens, although it describes many of the conditions under which they operate and the methods employed to assure the maximum of health and happiness to captive exhibits. It is rather the story of friendships and co-operation between the author and some of the more interesting of the animals, whom he regards as being created by the same powers that made man, being governed by the same natural laws, and offering a fascinating subject of study to all who love Nature.

For these reasons many technical descriptions usually found in books concerned with natural history have been omitted. Emphasis has been placed on the actions and reactions of certain animals under the close and sympathetic observation which only a scientifically conducted zoological garden can offer. A chapter on the varieties and care of pets has been included for the benefit of those who wish to study and enjoy the comradeship of animals within the limited confines of the home.

If the book stimulates the innate desire of the reader to study and enjoy man's friends of the wild; if it contributes in some degree to the pleasure of a walk through the woods or through a zoological garden; if it encourages a deeper sympathy for our cousins of the field, the forest, and the air, it will have fulfilled the author's purpose.

C. EMERSON BROWN.

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My Animal Friends

CHAPTER I

ANIMALS IN CAPTIVITY

PRINCESS, our majestic though temperamental lioness, had gone into seclusion. For days she had remained in the huge wooden cavelike box erected along one side of her spacious cage. Over the bars of the enclosure itself hung long tarpaulains, shielding the interior from the gaze of the curious, whether man or beast. On the flooring near by lay thick folds of burlap to deaden the sound of the keeper's feet. Once a day twelve pounds of meat and a bowl of water were slipped quietly between the bars. If Princess deigned to eat, well and good. If she declined, the food was removed after a few hours and fresh meat supplied the following day. Otherwise Princess enjoyed all the privacy to which she was entitled by reason of her rank and her accomplishment.

For Princess had done that for which all officials of zoological gardens hope. She had presented the zoo with a litter of cubs. How many, we did not know, and sternly we repressed our urge to learn. Princess, like all lionesses, was a jealous mother. An effort to peer into her wooden cave might have sent her into a paroxysm of rage or terror in which she would have destroyed her offspring. This has happened many times and in many collections. Even a loud or disturbing noise near by might bring evidence of that odd quirk of animal psychology which prompts carnivorous mothers in captivity to kill their young at the first suggestion of danger. Hence the elaborate precautions. In due time, we knew, Princess would lead her cubs into the cage itself, cuff them around a bit for discipline's sake, and spend the rest of her time regarding them at play in a spirit of fatuous pride.

To us that pride seems honestly earned. Again Princess had more than justified the care and the money lavished on her. Those cubs would make a welcome, though perhaps temporary, addition to our collection. But, what was more important, they would almost double the number of persons attending the exhibit, thus increasing the public interest in an understanding of wild life, which is, of course, the fundamental object behind any zoological garden.

Few features of any such collection have quite the attraction of a litter of very young lions. This is quite understandable to anyone who has watched the soft, furry little animals at play. Soon news photographers would snap them at their cutest antics, reporters accord them a temporary fame, and for weeks of Sundays the turnstiles would click cheerfully in response to their appeal.

I tell this story for two reasons : first, to illustrate the care and affection devoted to the individual specimens in any scientifically directed zoo, and, second, to show the importance attached by those in charge to any event which will increase its general educational service to the community.

Zoological gardens are increasing in size and in number throughout the world. With the growth has come a corresponding increase in knowledge concerning the care and comfort of their inmates, and a quickening of public interest in the great wealth of existing wild life which they maintain. There can, of course, be no doubt that wild life is at its best in its free native haunts, yet so few persons have the opportunity to observe it under such conditions that but for the zoo the possibility of actually seeing and studying undomesticated birds and animals would be limited indeed. For any interested observer to visit the various countries of the world and study in their native haunts even a small proportion of the animals exhibited in a large zoo, would require years in time and a fortune in money.

Nor, in my opinion, are the animals seen in such collections necessarily less happy or less healthy than those in their natural surroundings. Even in the prime of their existence animals in the wild state are almost constantly in danger of death from various causes. The protection afforded such animals in the zoo tends to lengthen rather than to shorten their lives. In the majority of cases, also, they suffer less, provided always that proper food and scientific, humane treatment are assured. Captivity actually gives dual protection, in that the animals are guarded against their natural enemies as well as against starvation and disease.

It is not necessary to go far afield for evidence of this. Consider, for example, the common Bob-White or quail, with which we are so familiar. From the time the young birds leave their eggs until they reach maturity they are in constant danger. Their nests are built on the ground where the eggs and young are easy prey for snakes, cats, and other small carnivorous animals. If they survive until they are able to run around, they must watch constantly for hawks that dart down with frightful velocity and unerring aim. As autumn approaches they are confronted by still greater dangers from hunters and dogs that find them in their snug hiding-places and kill many of them. Then, those that escape such hazards must face the added menace of winter, when many in the northern parts of their range become entrapped under a heavy crust of snow which imprisons them until death from cold or starvation results.

How different is the life of these friendly little birds in captivity! They are kept in large cages where none of their natural enemies can approach; they are given warm shelters in which to rest; fresh food and water are served daily, and sanitary conditions are maintained at all times.

Animals, like human beings, are subject to various diseases. This is true of them in the wild state as well as in captivity. In the largest and best zoological collections autopsies are performed upon all animals after death, and it is a noteworthy fact that nearly all that have been killed by their own cage mates show evidence of having had some disease that weakened them and would probably have caused an early death. I believe that this may also be true of animals slain by their own kind in the wild.

In a modern scientifically conducted zoo, however, no animals are allowed to suffer long from disease or injury. Competent physicians are available to assure them careful medical or surgical treatment. For the past few years rapid strides have been made along such lines. In some cases where minor operations seem necessary, they are performed upon the animal with the same painstaking precision as is employed in operations in the most modern hospitals, and result usually in complete recovery. Similar diseases or injuries, if suffered by the animal in its native haunts, would result in permanent injury or slow and painful death. One reads occasionally of birds or animals that perform remarkable operations upon themselves by bandaging broken legs with leaves or clay or otherwise mimicking modern surgical practices. Such stories must be classed among those nature-lore fallacies of which the hoop snake which takes its tail in its mouth to roll downhill is a classic example.

There are, of course, many cases where Mother Nature takes care of injured wild animals. I have seen a deer with its left foreleg off at the knee with the wound entirely healed and the animal apparently in excellent condition.

A friend of mine once shot a duck that had previously been wounded. He found the shot embedded in the fractured foot. That this duck lived long enough to heal the fracture indicates that at the time of the injury it must have been young and vigorous enough to keep itself supplied with food, as it was unable to leave the water. It is generally conceded that if a dog or cat receives a cut or bruise it will clean and heal the wound by lapping it. Wild animals in captivity have the same practice, and it is often better not to attempt to heal the wound or even cleanse it by disinfecting. But these are minor injuries. Severe ones almost invariably result in death.

It is difficult to say what ages animals may reach in the wild. Owing partly to their protection from natural enemies, partly to the careful attention they receive and the sanitary conditions under which they live, we know that many attain long life in well-conducted zoological collections. From the Philadelphia Zoo, which is one of the largest and most diversified collections in the world, may be cited numerous cases of remarkable longevity. There was, for example, the little brown cebus monkey from South America, with a record of twenty-seven years of life in captivity, who until his death in 1930 was apparently happy and in perfect health. As he began to show signs of old age, the dark-brown hair on his head turned white in several places. There was also the extremely large Indian elephant Bolivar, who died in 1908 at the age of forty-seven years. Bolivar, the records show, was presented to the Philadelphia Zoo by Adam Forepaugh in 1888, at which time he was said to be twenty-seven years of age. Before entering the zoo he had had a varied circus career. His height when received was nine feet eight inches, and his weight ninety-six hundred pounds. At the time of his death he weighed twelve thousand pounds and stood a trifle over ten feet in height. Regardless of the many tales of elephants living for more than a hundred years, I doubt if the average life-span of these huge animals is ever much over fifty to sixty years.

Two grizzly bears which have lived at the Philadelphia Zoo for twenty-eight years are still in excellent health as this is written. A white-handed gibbon, the smallest and most delicate of the anthropoid apes, has spent a happy and contented life there for more than twenty-five years. He still eats his meals regularly, and swings about his cage from rope to trapeze with the same vigour and agility as he showed when he first arrived. He has passed through several slight illnesses and received in each as much attention from the attending doctors as if he were a distinguished patient at some first-class hospital. His food, carefully prepared each day, seldom varies from the established diet of oranges, boiled rice, tapioca, milk, and bananas.

Another remarkable record of longevity is that of the egg-laying mammal the echidna, sometimes called the spiny anteater, which is so difficult to keep in captivity. By living in his small cage for no less than twenty-seven years he has made a record far beyond any ever established in captivity by his kind. Despite his years, he is still healthy and lies in his shelter box snugly curled up during the day, coming out into his cage just at dusk, when he partakes of the one egg and the one pint of milk that constitutes his diet.

A hyacinthine macaw, a member of the parrot family, has the record for birds, having lived in the Philadelphia Zoo contentedly for twenty-eight years.

It would, of course, be both hazardous and inaccurate to say that all animals are happier and longer-lived in captivity than in their native fields or forests. Certain specimens cannot endure the changes of food or climate which captivity in the populous centres necessitates, and such animals are usually missing from zoological collections. Until quite recently it was most difficult to keep gorillas alive and well in captivity, but many of the problems affecting them have been solved. There are, at this time, no less than five of these interesting animals in the zoos in the United States. The American moose has also been considered a difficult species to keep in captivity, but as we learn more regarding methods of caring for it, the animal has become a far more common exhibit. Oddly enough, the American elk or wapiti, a close relative of the moose, thrives and breeds well in careful managed zoological collections.

Apart from physical well-being, many animals, I believe, learn to enjoy their friends and visitors at the zoo. Some apparently experience a never-failing delight in showing off before crowds. Many form quite touching friendships with the keepers and guardians. The majority of them respond quickly to kind words and treatment and seem to realize unerringly those who regard them with affection. Sometimes I believe they have more acute senses than man in this respect. I have personally come in contact with many specimens of what were regarded as the wildest lions and tigers, and nearly always have been able in a short time not only to approach but to pet them. Probably the most fascinating feature of my activities as director of the Philadelphia Zoo is the daily round of visits to my many charges. It is a period of comradely greetings. In the monkey house, Bamboo, the baby gorilla, and Marianne, the chimpanzee, will see me in the crowd and rush to the front of the cages with cries and gesticulations of pleased recognition. Maggie, the orang-utang, may hold up her baby proudly for my inspection. Lizzie, the elephant, curls her trunk upward in salute. The hippopotamuses open their cavernous mouths in what looks like a threat but is merely a friendly greeting. The peacock spreads his iridescent tail. I return their salutes with words or gestures of friendship, happy, as I always have been, since boyhood, in the companionship of animals.

CHAPTER II

THE GREAT APES

IN one of the spacious cages of the Philadelphia Zoo there lives and plays a youthful member of the distinguished primate family whose fame has spread over much of the world. He is, as this is written, a five-year-old gorilla—one of the oldest in captivity. To his cage come, almost daily, anthropologists, naturalists, and psychologists from noted universities in this and other countries, eager to study his most casual movements and emotions. He has been the unconscious model for countless sculptors, painters, and photographers. His measurements are filed periodically in carefully studied scientific records. Among the crowds of visitors who come with no particular scientific motive in view, he is equally popular. His good manners, cheerful disposition, and amusing antics win immediately the hearts of children and adults alike.

Bamboo, which is the little fellow's name, receives an amount of care and attention comparable almost to that lavished on the youthful scion of some great and wealthy family. During his babyhood he was under the constant surveillance of a trained nurse and physician, as well as of his efficient, sympathetic keeper, and spent many hours cuddled in their arms as happily and affectionately as any infant. During the first half-year of his residence with us he was insured at a rate so high that the premium cost us one hundred dollars a month. To-day he receives a carefully balanced diet and regular medical inspection. He has two spacious playrooms, one indoors and one in the open air, and a constant simian companion to protect him from the pangs of loneliness. Of course, Bamboo more than repays all this attention, not only because of his great value as a scientific specimen, but because of the number of visitors he attracts to the zoo who, after observing him, will inspect, with the interest and sympathy which we always seek to arouse, our other fascinating exhibits.

Bamboo was purchased at a nominal sum on the West Coast of Africa by a sea captain. With him was acquired a young and very mischievous chimpanzee whom we have named Lizzie. Gorillas in captivity become very morose and gradually pine away for lack of companionship, and for that reason

Lizzie was brought along in the same cage. The two arrived at the Philadelphia Zoo in small handbags on August 6, 1927, and were met at the entrance by a file of reporters, cameramen, and moving-picture machines large enough to suggest a Presidential visit. To this reception committee Bamboo and Lizzie paid little attention. To-day they still play together happily, although Bamboo is increasing in weight and strength so rapidly that he often pummels Lizzie for annoying him. He remains tractable and affectionate with his keeper and has increased in value to many times the six thousand dollars which we paid for him.

Immediately after his arrival Bamboo was fed on milk and barley-water. Now, however, his diet is more varied, although a rigid feeding schedule is still maintained as follows:

6.30 a.m.	1 pint buttermilk
8	2 bananas and 1 orange
11.30	4 slices Zwieback soaked in warm milk
1 p.m.	1 pint buttermilk
2	All the lettuce he wants
3.30	Slice of bread spread with honey
4	Zwieback in warm milk
4.30	1 pint buttermilk
5	1 apple and 1 teaspoonful cod-liver oil

He is also given one tablespoonful of limewater in his drinking-water daily, and a little salt is thrown into his cage every other day. This regular diet, with the addition of a few titbits such as prunes and figs, has kept him in excellent health.

Despite his cheerful disposition, Bamboo has all the mischievousness of a four-year-old boy. He plays tag with Lizzie, throws great handfuls of loose hay out between the bars at approaching visitors, and swings merrily on his chains. At any moment, however, he will leave his playthings to rush to the keeper for food or for a short wrestling-bout. Often the keeper tickles him until he grins and finally laughs aloud. Undoubtedly much of his health and a large percentage of his happiness are due to his great affection for this guardian who pets and plays with him. Soon, however, I believe, assistant keepers at least will have to be more careful in approaching him as his strength develops. One day an assistant, after feeding him, unthinkingly turned his back as he stooped to go through the door. Like a flash, Bamboo leaped to the swinging chain and with a powerful lunge forward struck the keeper with his feet, hurling him through the door. Bamboo has not yet acquired the habit of wild gorillas, who stand up and beat their chests, but at times he does attempt it rather lightly with one hand.

I believe Bamboo's growth has been normal, averaging about two pounds a month. In time he will become enormous. There are records of full-grown gorillas weighing three hundred and fifty pounds. A new-born gorilla weighs from three to three and a half pounds, while a normal baby weighs six pounds or more. This is a noteworthy fact, showing the much more rapid growth of the animal. Illustrating Bamboo's swift growth are the following measurements taken by Dr. Adolph H. Schultz of Johns-Hopkins Institute :

	December 3, 1927	September 9, 1928
Sitting height	—	489 mm.*
Thigh length	124 mm.	—
Leg length	108 mm.	—
Foot length	128 mm.	163 mm.
Foot breadth	38 mm.	43 mm.
Upper arm length	162 mm.	—
Forearm length	127 mm.	—
Hand length	113 mm.	140 mm.
Hand breadth	50 mm.	65 mm.

The gorilla belongs to the highest order of mammals—the primates—which includes man, the great apes, baboons, monkeys, and lemurs. It is the largest of the anthropoid or tailless apes, among whom are also the chimpanzee, orang-utang, and several species of gibbon. The late Carl Akeley, one of the greatest of modern authorities, who lived in the gorilla country months at a time, told me that he found them absolutely harmless if not disturbed or wounded. Upon the approach of man the female runs away shrieking, accompanied by the young, while the male sits for a moment with a savage expression on his face. Slowly then he rises, looking with glowing, malignant eyes at the intruder, and, straightening up to his full height, begins to beat his breast with his fists, lifting his massive head and uttering the characteristic roar. This consists of several sharp barks like those of a mad dog, followed by a long, deep, guttural roar which continues for a minute or more, vibrating through the forests and hills like the deep, rolling thunder of an approaching storm. The appearance of the animal at this time can be compared only to a horrible nightmare. These animals only ask, however, to be left alone in their own domain to raise and care for their families in peace. Almost all their instinctive habits are closely comparable to those of man. A mother will fight to the death in protecting her young, much as any human mother would do.

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* One inch equals 25 millimetres.

In a case quoted by Dr. Savage, "A mother discovered in a tree with her young watched closely the movements of the hunter, and, as he took aim, motioned with her hand in the same manner as a human being would, to have him stop." When wounded, gorillas have been described as trying to stop the flow of blood by holding a hand over the wound, or pressing leaves and grass over the spot. All nature-lovers feel, I believe, that such wonderful animals, closely related to man, should be permitted to live their lives in peace. Following the humane plan proposed by Carl Akeley, the Belgian Government has established a sanctuary for them in their native African haunts so that these interesting giants may not be wiped from the face of the earth.

Meanwhile, the species is being preserved also in zoological gardens. Until 1923, few of the beasts had been brought into this country alive; only five had been landed, and none lived for more than a year. Since then, for some unknown reason, they have become more plentiful, until by 1930, as I have said, there were five living specimens in the various zoos of the United States. All were young, ranging from two to about five years of age.

Despite his many interesting characteristics, the gorilla, to my mind, is less intelligent than his cousin the chimpanzee, undoubtedly the brightest and quickest to learn of all the anthropoid apes. Almost every modern zoo has at least one of these animals, which adapt themselves quickly to captivity and are rather easy to obtain. Even as babies less than a year old, they are active, and their bright eyes and intelligent expression always attract attention. Few chimpanzees, however, are born in captivity, and unfortunately a very small number of those thus brought into the world survive. It is therefore a notable event when such births occur.

On October 1, 1928, a male chimpanzee was born in the Philadelphia Zoo. He seemed to be in perfect condition, but while the mother would fondle and pet him she steadfastly refused to nurse her wee offspring. Fearing the little fellow would starve, we removed him from the cage and kept him wrapped in a blanket in a warm place. Within a few days he began to take milk from a medicine-dropper regularly, and soon graduated to a nursing-bottle. Before long he was acting much as a human baby might, watching closely various prominent objects, and following with his eyes those that moved. Now and then he would coo to us. Day and night nurses were retained for him, but in spite of all our care and attention he died at the age of six months. Eighteen months later a second baby was born to the same mother. This time she began nursing it at once. The young chimpanzee promises to grow into a sturdy animal and at present is full of energy and playfulness. To me the babies of the great apes have always been the most interesting animals in the zoo. I shall have more to say of them in a later chapter.

Chimpanzees have been advertised as gorillas by circuses and sideshows, but no one who has ever seen a real gorilla could be thus deceived. They are more active than their big cousins, deriving apparently great pleasure from raging about their cages and showing off to visitors, especially when crowds have gathered. Their diet consists of eggs, milk, bread, oranges, bananas, prunes, figs, and, in fact, almost every food that we ourselves eat, with the exception of meat. So far as my experience goes, they are rigid vegetarians. On this diet they far surpass humans in strength. They possess an imitative faculty that is truly remarkable. In their very early years they are able by observation to learn and do nearly as much as a normal child of the same age. Josephine, one of our specimens, was able at about three years of age to tie and untie my shoe-string after having been shown only four times how the trick was done.

She learned also to bring a stool to sit on when her meals were served, and would rest on it comfortably with legs crossed while she ate her bread-and-milk with a spoon. Napoleon, another of our pets, and one of the best-natured chimpanzees I have ever handled, has learned by observation to work a camera, blow a horn, and pose for his picture with a hat on and pipe in his mouth, although he is only five years old.

This peculiar power of observation and imitation can sometimes make the chimpanzee a dangerous captive. If a keeper should happen to leave his keys in the cage of almost any other animal, nothing serious would happen. But not in the case of the chimpanzee ! From observation this intelligent animal has probably learned how to unlock the door, and will not hesitate to do so and escape. Even when there is no key in the lock, a chimpanzee will often insert a small stick or piece of straw and go through the motions of opening the gate. Many amuse themselves for hours in this way. They are always on the alert to see what mischief they can get into—trying out their strength on their cages; attempting to loosen nuts and bolts or to rip up the flooring. As a result, it is necessary to inspect their cages daily, since an unruly chimp with the strength of four or five men is a dangerous adversary to deal with when at large.

Very often these imitative traits can be directed into useful or amusing channels. The famous chimpanzee Mimi, who lived in the Philadelphia Zoo for more than twelve years, would point to her nose, eyes, or each as requested, sweep the floor, and do many other interesting tricks. At an early age she, acquired the habit of smoking cigarettes, and puffed away at them with evident enjoyment. When finished she would pass the "butt" out through the bars to the keeper, never letting it fall on the floor, where it could have caused a fire. The only thing she feared was a gun. Many times, when she had succeeded in one of her violent moods in ripping up floorboards or breaking a bar, I have driven her to the outside cage while the damage was repaired by firing a revolver.

A most interesting feature of the chimpanzee is the ability to indicate by signs what he wants. I recall a most intelligent specimen named Bobo who possessed this power to a marked degree. One hot summer day I noticed him lying in his cage. I stopped and spoke to him.

"Why don't you go outdoors and get cooled off, Bobo?" I asked.

He walked to the door, took hold of the padlock, and shaking it vigorously looked at me as if to say, "That is why." The door was locked, and he wanted it unfastened.

On another occasion a carpenter was in his cage making repairs. After the job was finished, the keeper noticed a nail that the carpenter had dropped. A nail in a monkey cage can be dangerous, as the animal might swallow it. The keeper told Bobo to get the nail and bring it to him, at the same time pointing to it. Without hesitation Bobo walked over, picked up the nail and, after examining it for a moment, handed it to the keeper.

Once a newspaperman spent some time photographing near Bobo's cage. Bobo showed great interest in this work, watching the operator carefully. Later the camera was placed within his reach. Bobo immediately reached out, put his fingers on the release lever, and worked it. He then turned the camera over and wound it just as he had seen the operator do. Several times he repeated this without a mistake. The act was accomplished entirely from observation, as, to my knowledge, he had never been taught to use a camera.

I do not wish to create the impression that I believe the great apes are endowed with the intelligence of the human, but I am convinced that they have a certain amount of reasoning power.

Dr. William T. Hornaday, in his authoritative book *The Minds and Manners of Wild Animals,* describes most interestingly the mental traits of these and other beasts. While the apes cannot talk, they do have means of communication among themselves. Their voices, when used, are loud and penetrating; their shrill screams and yells carry over great distances and can be bloodcurdling to the uninitiated. Generally they walk on all fours, seldom assuming an upright position without holding on to something. In walking, the fingers of the hands are folded under, so that the knuckles rather than the palms bear the weight.

Recently we added to the collection of the Philadelphia Zoo four apes from the extraordinary collection of the estate of the late Madame Rosalie Abreu, at Quinta Palatino, Cerro, Havana, Cuba. This gave us a total of fifteen anthropoid apes, including seven chimpanzees, five orang-utangs, two gibbons, and a gorilla, the largest collection in the world. Madame Abreu, before her death, was really the only person to succeed in raising captive-born chimpanzees to maturity. A remarkable woman, intelligent and refined, she had a sense of understanding of animals far beyond the ordinary. She did much to further investigation of the anthropoid apes, and her knowledge and sincerity of purpose along these lines have proved of great value to science. When I first visited her estate in 1929, before her death, she told me of her profound conviction that the apes have unusual senses not possessed by man. For example, she believed they have powerful eyesight, somehow similar to the X-ray, whereby they can see through such solid substances as wooden partitions. She believed, too, that they can sense death among others of their kind even when out of sight. Even religious understanding, she said, was possible to her charges and could be demonstrated by actual experiments.

I was, of course, greatly impressed by the apparently intelligent actions of Madame Abreu's entire collection of apes, as well as by her wonderful control of them. To see these enormous chimpanzees taken from their cages each night and led up the massive stone steps into her palatial home offered a remarkable example of her control. Apes that could kill a half-dozen men, and held on tiny chains hardly capable of holding a small dog, she led quietly into a room on the second floor, where they spent the night. I have handled many such animals, but I do not hesitate to admit that I had a real sense of misgiving when those apes were practically turned loose beside me, and breathed a heartfelt sigh of relief as they disappeared behind the large doors of her castle. Yet Madame Abreu was of slight build and would have been unable physically to cope with even a small chimpanzee. Her death in November of 1930 was felt as a great loss to all who are interested in the fascinating problems concerned with the study of animal life.

Like the gorilla, the orang-utang, or "man of the woods", is more sluggish and sullen than the chimpanzee. This animal is large and powerful, with long arms and hands. Living principally in the trees, it prefers, even in captivity, swinging from limb to limb or from bar to bar to walking. Nevertheless, like all anthropoid apes, it appears to reason to some degree from cause to effect, and can find ingenious ways of assuring its own comfort or amusement. It is often most interesting to observe the methods a mother orang-utang devises to make her offspring comfortable. The young are quite tractable and can be taught to perform many amusing feats which they seldom forget. The natural expression of all orang-utangs is that of solemn and dejected human beings. While the gorilla is nearly black in colour, and the chimpanzee a very dark brown or black, the orang-utang is a bright reddish brown. Once seen together, the three apes cannot be confused.

The Philadelphia Zoo has been most successful in breeding orang-utangs, having had two born within a period of two years. The first birth of one of these animals in captivity occurred at Nuremburg, Germany, but the specimen lived for only a few days. The second birth in captivity and the first in America occurred at Philadelphia on September 25, 1928. This youngster lived for a year. The third was born on Madame Abreu's estate in Cuba in 1929 and the fourth in the Philadelphia Zoo on July 11, 1930. All young orangs seem to be stupid and inactive, particularly when compared with chimpanzees. They cling tightly to the mothers and for several months make no attempt to walk or creep. The mother of the first born at the Philadelphia Zoo taught it to climb by placing its hands on the bars of the cage and gently lifting it up, her arms always beneath it to keep it from falling. When the youngster attained a height at the limit of her reach, she would gently loosen its hands from the bars and lift it down.

Success in breeding orang-utangs lies partially, at least, in the ability to secure a good mature pair. Young specimens, according to my observation and records, seldom live to be old enough to breed.

Of all the immature specimens purchased by us during the fifty years of the gardens' existence, not one has lived to be more than six years of age. The parents of the two mentioned above were purchased when fully adult.

Although a member of the family of anthropoid apes, the gibbon is much smaller than the others. The specimens most commonly seen in the zoological collections are the white-handed gibbons, natives of the Malay Peninsula. They are slender, delicate-looking animals when compared with others of this group. Their arms are extremely long, reaching almost to the ground when they walk. In their native haunts the gibbons remain in the tree-tops, jumping and swinging from tree to tree with great rapidity. They are said to be able to move so rapidly in this manner that they can catch flying birds.

In the zoo at Philadelphia lives Bobby, an old male white-handed gibbon, who arrived here more than twenty-four years ago and who is still living in apparent health and happiness. He is quite expert on the ropes and trapeze, spending most of his waking hours at this exercise. His longevity is due, I believe, largely to his constant exercise, the clean and sanitary conditions under which he lives, and the careful selection of his food.

Unlike most gibbons, Bobby discourages familiarity. The keeper must always be armed with a stick when entering his cage. Despite this precaution, the animal has made flying leaps and bitten the keeper on the arm and leg on several occasions. Bobby's greatest accomplishment is music. He delights in keeping up an odd sort of song for hours, especially on a rainy or dull morning. To a trained musical ear the song might be disagreeable, but to me it represents rather a pleasing and interesting performance. It is interesting also to observe the grace and rapidity of Bobby and his kind in the tree-tops. Sometimes in the very midst of their leaping flights they will seize branches and, raising their bodies as if by magic, come to complete rest so quickly that it is almost impossible to follow the exact movements.

CHAPTER III

MONKEYS

BEFORE each cage in the monkey house of the Philadelphia Zoo stands a plate-glass window ten feet high. Actually these windows meet, forming the sides of a central arcade through which visitors pass with unobstructed view of the interesting specimens within.

Many visitors have expressed their appreciation of this arrangement. They believe its object is to protect them from the active little exhibits within. To some degree they are, of course, right. But to a greater degree the object is to protect the valuable and often delicate specimens from the dangers represented unconsciously by the visitors themselves.

Thus guarded, the captive animals are comparatively safe from the possibility of infection, which may occur when thoughtless children spit at them; when older visitors cough into the cages, or wave germ-laden handkerchiefs playfully at animals peculiarly susceptible to tuberculosis; when peanuts or other inappropriate food, often carried loosely in pockets with such handkerchiefs, are thrown to them. Although erected little more than a year before this was written, the plate-glass barrier has already demonstrated its value in the better health of the specimens. When one realizes that the cages contain a mandrill worth one thousand two hundred dollars, three grown chimpanzees, and a baby worth much more than that amount each; three orang-utangs with two babies of tremendous value, a young gorilla worth at least six thousand dollars, eighteen kinds of monkeys, and several specimens of baboons, gibbons, and drills, the wisdom of the safeguard becomes doubly apparent.

The plate-glass represents, however, only one of the many modern features of this recently designed monkey house. Behind the glass, three air-conditioning units are set up in iron balconies to draw in fresh air, which is warmed by thermostatically controlled steam pipes, forced through a spray chamber filled with atomized clean water, and expelled over the tops of the cages. By means of automatic humidity regulators the units are turned on when the air falls below 50 per cent relative humidity. This process continues day and night without attention from the keepers. The idea, of course, was adapted from industry. Air-conditioning units with a capacity of 2,500 cubic feet per minute each were used in hundreds of factories demanding regulated humidity long before anyone ever thought of applying them to the problem of keeping monkeys healthy. Yet monkeys are physiologically so much like man and so subject to the same diseases, including colds and their consequences, that it is odd no one thought before of utilizing for them the process of air conditioning. Observations made thus far indicate strongly that the plate-glass partitions and air conditioning will lengthen appreciably the lives of our monkeys. We know that it has already eliminated the offensive odour in the monkey house, and that the animals themselves seem more frolicsome and happier. Draughts, coughs, and sneezes are no longer a menace. "Don't Feed" signs, nearly always ignored, have become unnecessary. The innovation, it seems reasonable to suggest, may in time revolutionize zoological collection practices, so far at least as the monkey houses are concerned.

With the great apes, the monkeys and baboons share apparently the greatest interest shown by visitors in zoological exhibits. Often the expressions on the faces of both children and adults as they gaze on the exhibits are as interesting to watch as are the animals themselves. Many show fear as the great anthropoids stamp or glower; all show only curiosity or amusement at the antics of the smaller monkeys. Caution, of course, among visitors as among keepers, should always be encouraged. Exactly as with humans, all known species of animals have instinctive habits, and each individual has its own peculiar temperament and traits. Some one of a species may be quite gentle, while another of the same age and sex will be dangerous. It is therefore unwise to generalize or to assert that all animals of any one class can be thoroughly trusted. It is always safer to approach any wild animal, even one that has been considered a pet, with caution, since for no apparent reason it may become vicious.

The monkeys and baboons usually seen in zoological collections may be divided into two great groups; the platyrrhine monkeys of the New World and the catarrhine monkeys of the Old. The American monkeys have flat noses with nostrils directed outward, one widely separated from the other by a broad cartilaginous septum, and are therefore designated as platyrrhine, or flat-nosed. In the

Old World monkeys, the opening of the nostrils is directed downward, as in man, with a narrow, elongated nose, and nostrils close together. Therefore they are designated as catarrhine monkeys, or monkeys with a "down nose".

The baboons, of which there are numerous species, are, as a rule, easily distinguished from the monkeys by their massive, long, straight, dog-like noses and generally short tails. The tails, while varying greatly in length, are never prehensile, and the animals, consequently, cannot use them to grasp things. Baboons walk on all fours, placing their feet flat on the ground, and usually travel in colonies or droves. Some of these animals are dangerous in the extreme. Their great canine teeth can inflict very severe wounds. They are able to throw stones and other missiles with great speed and excellent aim, using the underhand swing.

The handsomely coloured mandrill, with head, face, and rump tinged with bright red, blue, and grey, is a member of this family. Apart from their proud carriage, mandrills have a dignified habit of greeting friends by raising the upper lip, showing the teeth, and nodding the head from side to side. Generally they are good-natured, and, in my opinion, among the finest of the baboons. Their brilliant colourings are not acquired until full maturity. When the animals become enraged the colours grow more vivid.

The drill is another large baboon of the same general type, but is easily identified by the entire lack of bright colours. Its distinguishing characteristic is a black face with a wide ring of white hair around it. The Guinea baboon, sometimes called the dog-faced, is ugly and treacherous, like the hamadryas baboon from Arabia. This latter animal, however, boasts quite an impressive air, with its long nose almost entirely devoid of hair, and large mane or mantle on the throat, neck, shoulders, and back.

The chacma, another species of baboon, is rather common. These are large, fierce animals of dark brownish-grey colour. Natives of South Africa, they live well in captivity and are extremely intelligent. A famous male, Oom Paul, has been a guest of the Philadelphia Zoo for more than twenty-three years, and is still in good health as this is written.

Much of interest and benefit to humanity may be learned from members of the monkey family, as well as a great deal regarding diseases. Monkeys, as has been indicated, are quite susceptible to tuberculosis. Years before measures for the detection of this disease were adopted, many such animals succumbed to the malady. While the "white plague" probably does not find many victims in the wild, the specimens are easily infected when brought into contact with human beings. Actuated by the desire to afford the public a splendid exhibition of healthy animals, the Philadelphia Zoological Society several years ago adopted the rule of testing all monkeys arriving in the garden before they were placed in their respective cages in the monkey house. Therefore, all specimens exhibited are free of the disease, and the garden is able to show a large, interesting, and healthy collection in the monkey house at all times.

Despite their Southern birthplaces, several species of monkeys may safety remain out of doors during the entire year. Foremost among these is the *Rhesus mdcaque,* which seems to enjoy itself outside in the coldest weather. Member of this species seldom become ill, offering living examples of the benefit of fresh-air treatment. These monkeys are most common and may generally be seen in even the smallest zoo, as well as in vaudeville acts and experimental laboratories. Their natural habitat is India.

The little cebus monkeys from South America, of which there is a great variety, are the familiar companions of the hand-organ grinders. Frequently they are called ring-tailed monkeys because of the long prehensile appendages by which they hang from the limbs of trees. Attractive little animals, they are quite popular as pets, although their nervous temperaments incline them to treachery and make careful handling necessary, particularly by children. With kind treatment many such pets live for years. In our collection is a cebus monkey presented to us by a lady who had kept it for twenty-eight years. Such small monkeys as the titi, squirrel monkey, and tiny marmoset often make good pets, as all are gentle and playful. They are very delicate animals, however, and rarely live for any great length of time in our Northern climate. In the wild they feed chiefly on fruit and insects. In captivity they thrive on a diet of bananas, sunflower seeds, apples, social-tea biscuits, meal worms, and a mixture of condensed milk and water.

CHAPTER IV

THE FLESH EATERS

CASUAL visitors to the zoo often ask if I am not in constant fear that some day one of the great lions will suddenly turn and attack me or the keepers. My answer is that I would far rather trust the most powerful lion, who is known to be friendly, than a mild-eyed buck deer with a full set of antlers. The lion, as a rule, is more dependable.

Like all who learn to know them well, I have great affection for these stately animals whose majestic appearance not even captivity can mar. Often, I suspect, their reputation for ferocity is greatly exaggerated. In zoological collections they are almost invariably tame and friendly, and even in the wilds they seldom attack man, particularly since the use of firearms has become common. Naturally, as with all species, individuals vary in temperament, and, as I have said before, no keeper, however experienced, is ever warranted in discarding all precaution.

I recall an interesting example of this difference in two lionesses who occupied adjoining cages at the Philadelphia Zoo. One was most gentle, affectionate, and trustworthy. Even when she had young she showed no sign of irritability. The specimen next to her, however, was one of the few vicious lionesses in my experience. Although born in captivity, which is commonly believed to assure a gentle disposition, this virago would dash wildly at the bars with fierce snarls and spread claws whenever a keeper passed inside the guard rails. When her cubs tried to crawl to the front of the cage at my call, she invariably dashed at them madly to beat them back with her enormous paws.

As a rule, however, lions have sanguine temperaments and are content to lie in their cages for hours, glancing down at the visitors with lordly and disdainful indifference. When you see a lion act in the circus you may be quite sure that the animals have been selected from a dozen or more for their good dispositions and ability to learn quickly. Those that seem difficult to train are usually sold to zoological gardens and in many cases develop into the finest of animals for exhibition purposes.

Tigers, as a rule, are less trustworthy than lions. Many are stealthy, nervous, treacherous, and suspicious. While the lion spends most of his time lying down, the tiger paces his cage, constantly on the alert. The wild beauty and grace of these animals, however, places them among the most popular of all exhibits.

As among lions, many tigers prove exceptions to the general rule. I recall a pair of Sumatra tigers sharing a cage in the Philadelphia Zoo who illustrated the fact. The female was most friendly and appeared to enjoy permitting her keeper or other friends to pet her. The male was not only intolerant of any attention to himself, but flew into a snarling, jealous rage whenever his mate was thus favoured.

Sometimes tigers in captivity are unjustly regarded as extraordinarily vicious, when they have only reacted naturally to what appears to them a serious threat. An instance of this once came to my attention at the zoo in Houston, Texas. In the collection was a large specimen of Bengal tiger named Tex. Apart from his beauty, he was so friendly that he was used daily in a small act to arouse the interest of visitors.

When Tex was due to go into the large exhibition cage, a heavy door in the lion house was lifted, and he passed out through a long tunnel. On the occasion I am describing, a visitor interested in zoos was eager to study this tunnel and, with the keeper, entered and walked to the door through which the tiger came out. The tunnel had a heavy outside gate and another beyond it which released the animal from its inside cage. Concerned with the working of these gates, the keeper raised the outside one, thinking that, as usual, the inside door was closed. For some reason, however, this was open, and suddenly both men were terrified to see Tex enter the narrow passageway. The visitor did what almost anyone would do in a similar predicament—he ran away. Tex, with no idea of attacking him, but with his attention fixed on the outside cage where he had been trained to go when the gate was lifted, ran down the tunnel, following closely on the heels of the visitor. Terrified, the man turned and struck the animal in the face with his hat. This was too much for almost any tiger. Instinctively Tex struck back with his powerful paws. There was a crack of the pistol in the hands of the faithful keeper, and the beautiful tiger lay dead. The visitor had been badly clawed, and the shot probably saved his life, but there is little reason to doubt that the death of this splendid specimen was necessitated by carelessness rather than because of an evil disposition.

When tigers are newly captured their rage can be terrible. Included in a recent shipment of specimens from Singapore to the United States was a very large Sumatra tiger destined for the Philadelphia Zoo. One night a great commotion was heard among the animals on the vessel, and the caretaker went below to ascertain the cause. As his flashlight was thrown on the big tiger's box, he was horrified to see that it had been overturned and that the massive head and one dangerous paw were already through an opening made by the tiger itself. The caretaker and his assistant, securing an old door that happened to be available, succeeded in pushing the animal's head back into the box. Then one sat upon the door while the other nailed down and reinforced the planks covering the opening.

Throughout the remainder of the voyage the tiger snarled and raged. Before he was shipped from New York to Philadelphia a new and far heavier crate was built to keep him secure. Despite this precaution, he succeeded in biting and clawing the hard wood so viciously that before he reached our collection, after a run of only a few hours, he was standing almost belly deep in chips. During the first few hours in his cage his rage continued.

Then gradually he quieted and made friends with me. To-day I do not hesitate to pet him. Actually he is an unusually gentle specimen—for a tiger—and was only expressing a not unnatural resentment caused by being rolled about in a small box. Had he escaped in this temper, however, he would have been a dangerous shipmate indeed.

The puma, or mountain lion, is among the most interesting of zoological exhibits. His temperament is sanguine, and his behaviour in captivity excellent. The peculiar cry of this animal has always been a subject of wide discussion. Many who have heard it in the wild insist that it resembles closely the cry of a woman in distress; others are unable to detect the likeness. As a matter of fact it does give the impression of the human voice and, since the note is high, resembles that of a woman rather than that of a man. Under any condition it is weird and, to those unfamiliar with it, most disconcerting.

Pumas inhabit both North and South America. Like many other wild animals in the United States, they are rapidly retreating before the advance of civilization, but may still be found throughout the wilder sections of the Far West. In South America they are still fairly abundant both in forests and on open plains. These animals are remarkable for their power of adapting themselves to conditions, and are as much at home in the cold or mountainous districts of the northern part of their range as in the hot, humid countries and canebrakes bordering the rivers of south-eastern United States and South America. They prefer, of course, secluded spots offering concealment. So far as I can ascertain they have never been known to attack human beings. Their chief food consists of large and small mammals, preferably such as Rocky Mountain sheep and deer in the North, and peccaries, tapirs, deer, and huanaco in South America. Since they are reputed to attack such formidable beasts as jaguars in South America and grizzly bears in the North, they may be regarded as the boldest and fiercest animals found in the New World.

The cheetahs, or hunting leopards, of Africa constitute another species of this group. Long-legged and lean of body, they are true hunters, able to run down the swiftest antelope. Generally they are quite tame and amenable to training. When used in hunting, the cheetah is first blindfolded, then taken to a spot where a herd of antelope has been sighted. When the blindfold and leashes are removed, the animal starts off in tremendous leaps and bounds towards the herd, soon over-taking it. He then either kills or holds his prey until the hunters arrive. Unlike other members of this family, the cheetah's claws are blunt and not retractile, more like those of the dog than the cat. For this reason one may pet it without fear of being clawed. The specimens which I have seen in zoological collections have been as tame as kittens, and enjoyed rubbing against the bars of their cages, purring and permitting themselves to be petted, and sometimes rolling over to show their pleasure.

Wolves, in contrast, are generally fierce, treacherous, cowardly, and untrustworthy. In captivity they are extremely cruel, regardless of how well they are fed. They have been known to sit for hours watching for a chance to get at an animal in an adjoining cage, who in a moment of carelessness may place a foot or tail between the bars. This they will catch and quickly chew off or mangle. Always, therefore, it is wise to place partitions of fine wire between their cages, leaving no holes or cracks.

Wolves usually travel in packs in winter, and at such times may attack anything from a lamb to a horse, including, in Russia, humans. It is said that during the year 1875 no less than one hundred and sixty persons were killed in that country by wolves. Fifty years or more ago an old settler at Moose

Head Lake, Maine, told of seeing a herd of caribou being chased across the frozen waters by a pack of wolves. Like the fox, the wolf displays extraordinary caution in avoiding all kinds of traps set for its destruction.

Foxes are timid, cautious, and very cunning, and therefore difficult to secure. Unless set by experts, traps are almost useless. Poisoned bait buried in the ground is sometimes effective, but the wily animals quickly recognize its menace.

The red fox, whose handsome pelt is much sought after, is a beautiful and graceful creature. The grey fox, while also beautiful, has a rather inferior coat, not so extensively used in the fur trade. Both red and grey foxes are easily available for zoological collections, and offer so few difficulties in maintenance that they are generally seen in most American zoos. The black fox is rarer in captivity, since it is not attractive enough to warrant the great investment it represents. While red foxes may be purchased at prices as low as ten or fifteen dollars, specimens of the black variety have been known to sell for twenty-five hundred dollars.

The various species mentioned herein represent but a small proportion of the many mammals that catch and kill other animals in the wild for their food. In captivity, the flesh eaters are served once daily a portion of clean, fresh horsemeat.

In our own butcher shop from three to six horses are killed every week. These are not sick or maimed horses, but those which have outlived their usefulness and are humanely slain for food. Every portion of the animals so killed except the hide, hoofs, and skulls is utilized. The meat is fed to lions, tigers, wolves, etc., the intestines to the birds of prey such as vultures. The heart is ground and roasted, to be used as an ingredient in our prepared bird food. The fresh liver is given as a laxative to certain animals of the cat family.

The proportion fed to some of the animals daily is as follows: lions, 11 to 12 pounds; tigers, 10 to 12 pounds; leopards, 2½ pounds; small cats, ½ pound; large foxes, 1 pound; hyenas, 4 pounds. If the meal is not readily eaten, a smaller quantity is given the following day, but if it is devoured at once and the animal seems eager for more, a larger portion is served at the next feeding. Horsemeat is preferable for wild animals in captivity, as it is less fattening and less expensive than beef. I believe also that the animals enjoy it more.

Some of the smaller species of the cat family make very good pets while they are young, but it is wise to proceed carefully in handling them, as many are capable of inflicting severe scratches and bites. I know of a woman, however, who had a tame jaguar, secured as a baby and raised on a nursing-bottle. It used to sleep for hours with its head and forefeet in her lap, even after it was nearly full-grown, and never made any attempt to scratch or bite. This, to my mind, is one case in many thousands.

As I have pointed out, the retractile claws of members of the cat family constitute their greatest danger. The harder one tries to pull away when clawed the more difficult it is for the animal to let go. An example of this occurred in the Philadelphia Zoo a few years ago when two cameramen attempted to take slow-motion pictures of our cat animals. I gave the required permission, at the same time cautioning them not to go too near their models. Some time later I observed the cameramen close to the cage of Sultan, the big lion. Sultan lay quietly in his corner looking over the situation. Another movement of the camera, bringing it nearer to the cage, made him prick up his ears, and again I urged caution. The photographers answered that they had taken many animal pictures and were accustomed to lions. Then one of the men approached a bit closer for a better focus. Suddenly Sultan, with one prodigious leap, landed one foot on the camera, sinking his powerful claws into it. Both men attempted to pull the camera away, but the harder they pulled the deeper the claws sank in, until finally the top of an expensive camera was torn to shreds and the claws released. I did not say, "I told you so," but the men had learned the lesson of how far and how quickly a lion could leap from a reclining position.

Bears as a family are usually untrustworthy. Very few over a year old can be trusted as pets. Even if their dispositions are gentle in youth, they become so large and strong that they are liable to injure their owners and keepers, not necessarily intentionally, but because of their rough method of playing. Generally of a nervous temperament, bears in captivity spend much of their time running rapidly up and down their cages, especially at feeding time. Many cubs of the common black bear are caught early in the season and sold to dealers or individuals to be kept as pets. For a while they are interesting, playful, and harmless. But they soon outgrow this and, while black bears are the best tempered and most trustworthy of all, even they should be regarded and treated as dangerous animals. As soon as one shows the least sign of ill-temper or roughness, it should be disposed of to a zoo or other institution before it can cause serious injury.

The European brown bear is another species as trustworthy as it is possible for a bear to be. This is the kind often to be seen being led along by a chain and now and then stopping to give an exhibition of dancing, much to its own discomfort and its trainer's profit.

The Himalaya bears are cunning, sly, and uneasy, always on the alert and looking for an opportunity to escape from the cage. They must be guarded closely. These animals are able to flatten themselves to an extent that makes it possible to squeeze through unbelievably small spaces. One bear of this species in our collection was kept in a cage with bars only three inches apart; yet he escaped by springing the bars in such a manner that after his exit they sprang back again until the space between them was too small for the entrance of a man's head.

In captivity bears seem to be contented. Their food consists of bread, carrots, apples, or other fruit and vegetables, with a little meat and fish. Polar bears receive, in addition, suet, horse fat, and fish oil. Fish is also on their menu to a much greater extent than among other bears.

Often I am asked how the polar bears endure the extreme heat of our summers. My answer is that they do not appear to suffer from the warmth in this climate, but lie contentedly in the shade of their dens and swim and play about in their pools with no marked discomfort, although they do enjoy the huge cakes of ice placed in their pools on extremely hot days. In fact, all animals, from whatever country, seem to make the best of any weather, hot or cold. They eat less, lie in the shade, and drink lots of water in summer. In winter they exercise more. Fortunately, too, for them, they have no thermometer to consult. Many humans would undoubtedly suffer less from the vagaries of weather if they employed similar methods.

The polar bear's home is in the Arctic regions, where it lives through the year, in summer playing on the ice and catching seals, as a rule, for food. During the long winter nights it hibernates in caves in the ice, into which it crawls, and allows itself to be entirely frozen over. At the top of such ice dens is always a small opening from which issues a steam caused by the warmth of the bear's body and breath. The Eskimo hunters can thus locate a bear and immediately dig the animal out and kill it for meat and fur. Polar bears live well in captivity and are therefore rather common in zoos, where they always arouse interest among visitors.

The common raccoon is another extremely interesting specimen common in zoological collections. Here it is protected from the fur hunter and lives out its life unmolested. Like the bear, the raccoon walks on the entire sole of the foot rather than on the toes, as do dogs, cats, and many other mammals. It is a splendid climber, living in holes in trees and spending much of its time lying in the topmost branches in the sunshine. In captivity the food of raccoons consists of bread, vegetables, and fruits, all of which they carefully carry to water and wash before eating, as in the wild. Green corn, of which they are very fond, also forms a part of their diet in season.

Another very handsome and attractive member of this family is the common panda, which makes its home in the Himalaya Mountains. In colour it is of a bright reddish brown with black rings around its tail and is prettily marked. In shape and size it resembles the raccoon, although its tail is much longer. Sometimes it is called the bearcat because its gait is similar to that of a bear and its feet like a cat's. In captivity it is fed on condensed milk mixed with water (half and half), and bamboo leaves, of which it is quite fond, and sometimes chicken heads or small pieces of meat.

The smooth and glossy coat of the otter, so attractive to the fur trade, is worn by a most intelligent little animal belonging to the great family of *Carnivora*. Its diet consists almost entirely of fish. Several years ago four otter kittens captured in Florida were taken into the home of a friend of mine and fed from a medicine-dropper and then from a nursing-bottle. They were most intelligent, and when their bottle was hidden they would find it and drink the contents unaided. After a while they became so tame that they ran freely about the house and lawn, answering to their names when called, and submitting with apparent pleasure to petting. Their owner, noting their intelligence, determined to train them. So effective were her methods that the animals would not only bring her slippers when ordered, but could distinguish between a blue pair and a pink pair, never confusing the two. Finally the otters joined our guests at the zoo, readily adjusting themselves to conditions. They spend much of their time swimming about in their pool or rolling around on the ground like so many kittens. In winter they make snow-slides on the slippery bank at the water's edge, where they spread their legs and, lying flat, glide into the water. Like all otters, they live well in captivity, are always interesting, and offer few problems in care.

One of the most interesting examples of parental discipline I have ever observed among the meat eaters occurred in our bear family. One day the mother of several cubs noticed a mischievous offspring climbing the wall at the back of his cage. She became obviously worried, and tried in every way to coax the cub down. When he refused to obey she climbed up herself, got on the opposite side of him, and kept pushing carefully so as not to throw him off and hurt him. Finally the cub reached the end of his climb and was obliged to start down. The mother followed him. When he was on terra firma she walked to his side and boxed his ears severely. The cub ran into a corner, where he cried like any child. I never saw him on this wall again.

CHAPTER V

ELEPHANTS

SOME years ago a student of animal psychology sought and obtained permission to observe the effects of music on various animals in the Philadelphia Zoo. The results were interesting, though in many instances disappointing to the investigator. The lions, for example, simply glanced indifferently at the musicians, then resumed their lordly attitude of complacent introspection. The chimpanzees were more encouraging. One even danced on all fours around its cage in perfect time to the beat, starting and stopping with the music.

Finally the band of musicians reached the elephant enclosure. At a safe distance from the chained captives they took their seats and began a soothing waltz. Throughout this rendition Poetre, our large elephant, stood quietly, waving her ears gently as if she rather enjoyed the concert. Then the band changed to a nervous jazz air. Poetre walked quickly to the edge of the bathing-pool, filled her trunk with water, then, before the musicians suspected her purpose, sprayed the entire band. She made a thorough job of it, too, waving her trunk from side to side so that each of the disconcerted players received his share before he succeeded in fleeing to safety.

It is perhaps the recurrence of incidents such as this that has won for the elephant its reputation for intelligence.

The elephants are undoubtedly the greatest attraction at any zoological exhibit. Especially do they interest children because of their massive size and the peculiar trunks, which they seem to keep in constant motion. The huge beasts, despite their bulk, are easily trained and managed. Most of them are brought to this country while quite young, but they are hardy, and generally reach a ripe old age when properly treated. There has been much discussion concerning the age of elephants. Not long ago a scientist toured the elephant country in search of reliable data on this subject. He visited many places reputed to have elephants a hundred or more years of age, tracing each back to its original owner, and failed to find one exceeding the age of sixty-five.

Elephants increase rapidly in both weight and height. Bolivar, the largest in existence at the time of his arrival at the Philadelphia Zoo in 1888, lived with us for more than twenty years, and when at last he died his huge body weighed more than six tons. All elephants are intelligent and possess remarkable memories. A newly caught specimen from the wilds brought directly to the zoo, shows, perhaps, greater adaptability than almost any other animal, wild, or domestic. Like many animals of great size and strength, elephants can be controlled by fear. They quickly learn who is master and, if treated kindly, become much attached to him. Performing elephants in circuses are sometimes able to do no less than thirty tricks, each of which is remembered and accomplished without error.

The most common of elephants in captivity is the so-called Indian variety of India, Java, Ceylon, and Borneo. These animals are used extensively in the East on such tasks as carrying logs and other heavy burdens. Apart from their intelligence, they are patient, and with their great strength make excellent workers. Typical of their long memory is the story printed in school books many years ago about the circus elephant who, while passing through a town in a parade, playfully put his trunk out towards a tailor sewing in front of his shop. The tailor mischievously pricked the trunk with his needle. Several years later the circus returned to town. As the parade reached the street on which the tailor lived, the elephant filled his trunk with dirty water from a puddle and blew the entire contents over the tailor and his stock in revenge for the needle-thrust. This tale always seemed a bit exaggerated to me, but as I became more familiar with elephants I began to suspect that it might have some foundation in truth.

The African elephant, in contrast to its Indian cousin, is wild and difficult to control. For this reason it is seldom broken in to work. Even in a zoo, a full-grown African elephant is something to be feared. The variety may easily be recognized by the head, which slants abruptly back from the trunk, and the enormous ears, which, when lying back close to the head, overlap at the top. The Indian elephant is bulkier and has a square forehead and much smaller ears.

Many specimens in captivity are known as one-man elephants: that is, they show considerable affection for the keeper, allowing him to do almost anything with them, but remain dangerous to all others who approach. One of this type was formerly at the Philadelphia Zoo. To her keeper she was most gentle, and would lie on the floor while he climbed upon her bulk and swept her off with a broom. He could also put her through a number of tricks. On one occasion the regular keeper was obliged to be away for a week and another man was in charge of her. Apparently the elephant disapproved. She awaited patiently her opportunity and one day when his back was turned rolled up her trunk and charged him. With her head held low, she struck the temporary keeper a severe blow, knocking him against the stone wall, which cut and bruised him severely. Upon the return of her regular keeper she showed every sign of pleasure. As he approached she gently wound her trunk around him in a welcoming caress.

Frequently I have seen pictures of elephants charging with trunk extended to the full length in front, but from what I can learn this seems incorrect, as most elephants charge with the trunk coiled up. This, at least, I have observed at the zoo.

Elephants love the water in hot weather, and if allowed to bathe will lie in it for hours. It is often difficult to get them to come out.

Next to the elephant, in zoological order, comes the hyrax, a strange, small animal sometimes known as the rock rabbit. It is one of the most interesting of all animals, and sometimes it is difficult to believe it can be related in any way to the largest of beasts. There are many species, all of which make their homes in Africa, Arabia, or Syria. In size, the animals may be compared with the common rabbit, but are of a light greyish-brown colour, with short noses and small, rounded ears. The peculiar formation of their feet and toes is really about the only visible sign to show their close relation to the elephant family. Their front feet are armed with short, broad nails ; the hind feet also carry two such nails and one long, curved claw, making three nails in all on each hind foot. In their native haunts these little animals live in communities in rocky places. They generally feed at night or in the early morning, on tender young shoots of trees and bushes. In captivity they are trusting and gentle and can readily be tamed. When alarmed, their cry is a sharp hissing noise. One that was in my charge for a number of years became so tame and friendly that whenever I approached his enclosure he would run to welcome me.

Other huge and popular guests at the Philadelphia Zoo are the hippopotamuses, whose home is in Africa. These animals usually live for many years, cause little trouble, and are trustworthy and even affectionate. Full-grown hippopotamuses may weigh at least three tons each. Despite their bulk, they are very quick and active. Their mouths are enormous, with large, long, sharp teeth, yet their throats are rather small. A specimen in the Cincinnati Zoo once caught a tennis-ball thrown to him, and in trying to swallow it choked himself to death. The two now exhibited in the Philadelphia Zoo have been there for more than eighteen years, and at this time are about twenty years old. They have had five offspring, which were either sold to or exchanged with other zoos at a valuation of from two thousand to five thousand dollars each. Both are most friendly with those whom they know. Coming to the front of their cage when called, they will open their huge jaws in grimaces of welcome. They delight in having the insides of their mouths rubbed. I have never known them try to close their jaws under such circumstances. Like the elephants, they have excellent memories, seldom forgetting an injury. One day a carpenter was working in the cage of the male, Caliph. When Caliph approached to investigate the activity the workman suddenly dealt him a smart blow on the nose with the handle of his hammer. Startled and enraged, Caliph backed away in preparation for a charge. The carpenter, dropping his tools, lost no time in climbing up the bars and over the top of the cage, while Caliph roared and raged around the tools until the keeper quieted him. This occurred four years ago, but to this day Caliph will recognize the carpenter and rage at the front of his cage until he is out of sight.

The food of a full-grown hippopotamus in captivity at the Philadelphia Zoo consists of one bucket of potatoes in the morning, twenty quarts of rolled oats and bran mixed half and half, four heads of cabbage, and about fifty-two pounds of hay in the afternoon. The young animals receive about half this quantity. At this time this diet costs about two dollars and sixty-five cents per day for each animal.

Another species of hippopotamus, much smaller in size, is found only in Liberia. It is known as the pygmy hippopotamus. A full-grown specimen weighs only about six hundred pounds. These animals were discovered about twenty years ago, but only a few have been exhibited. They are not much larger than well-grown pigs, and have smooth shiny skins, much darker in colour and not nearly so thick as that of the larger species. Not as fond of water as their bigger brothers, they spend much time in running through the underbrush. In captivity, they thrive on practically the same food as the common hippopotamus, in much smaller quantities.

Both these species, in the wild, live near the water, the common or larger ones spending most of their time in it. In captivity, therefore, it is important to supply them with large tanks containing water kept at a temperature of at least sixty to seventy degrees. Hippo babies must be carefully guarded against cold water and draughts, and watched night and day during their first few months to prevent accidents. The young of the common hippo remains under water while nursing, at intervals coming to the surface or sticking their noses up for air, then sinking again almost immediately. When at rest, the babies lay their heads on the mother's nose or lie on her back. At all times the mother keeps a baby close to her, seldom losing sight of it even for a moment.

Hippopotamuses are said to be capable of remaining submerged for fifteen minutes or more, but I have never seen one stay under for more than seven minutes at a time. As soon as the weather is warm enough the outside tanks are filled, and when the water shows the right temperature the animals are permitted to go into them. On their first day out of doors in the spring, they generally begin scooping up dirt and mud with their powerful jaws, working them exactly like steam shovels. Some of this dirt is eaten and acts as a spring tonic, a bit of old mother earth apparently being necessary to health.

Rhinoceroses are far more difficult to obtain. It is only a question of time when these curious animals will not be shown at all in zoos or circuses, as they do not breed well in captivity. There are in existence five different species, three in India and two in Africa. Both African species are of the two-horned variety. One African species is known as the black rhinoceros and the other as the white or square-lipped. The latter is becoming so scarce that, according to excellent authority, only about ten pairs exist. It may not be long, therefore, before this giant passes into the class of extinct animals. Both the African species have extremely poor eyesight in the daytime. When charging,if provoked, they rely largely on an acute sense of smell.

A large female Indian rhinoceros in the Philadelphia Zoo is one of the last to come out of India alive. She was captured and sold to us by Mr. Frank H. Buck, one of the most famous of animal collectors. During the summer of 1923, arrangements were made with Mr. Buck by both the Philadelphia and New York Zoological Societies to pay seven thousand dollars apiece if he would land in each of their respective gardens one rhinoceros in first-class condition. On those terms, Mr. Buck set out on his hazardous task and carried out the orders most satisfactorily. Later he told me personally the following interesting story of his adventure:

Nepal, where Mr. Buck made his headquarters, is ruled by a maharajah, who in that country is even more powerful than the rajah. Only because of Mr. Buck's personal acquaintance with the maharajah was he allowed to go into the country where white men are barred. The animals were captured by building a large corral and driving both young and old into it. After the calves were roped, the old ones were driven out. The calves were then pushed into roughly made crates and were hauled over thirty miles of bad roads on rickety two-wheeled carts drawn by Indian buffaloes. Two huge elephants were also taken along to carry food for the animals, as the trip consumed three days. At the village of Rexal, the crates containing the valuable animals were placed on the flat cars of a narrow-gauge railway and borne to the banks of the Ganges River, where they were transferred to a steamboat for the trip to Calcutta. They arrived there just in time to catch the S.S. *President Wilson,* which carried them to San Francisco. Thence they were rushed across the United States to their Philadelphia and New York destinations by train.

The Philadelphia specimen arrived on May 24. It was put on exhibition immediately, and in a few minutes stood quietly munching its food as if a voyage half around the world were nothing. As they look at some of the animals in the zoo, few people realize what a tremendous expenditure of time, expense, and trouble was required to capture and transport them.

In the East the rhinoceroses are considered the most valuable of all animals, as they are thought to possess great medicinal value. Skin, toenails, horn, and hair are all used in preparing various remedies. The horn is considered of exceptional medicinal value. Our animal, upon arrival, lacked a small portion of its horn. It was clipped off, probably by some native, to be stewed up and used as a tonic. When received at Philadelphia, the specimen was judged to be about two and a half years old, and weighed six hundred and forty pounds. It grew rapidly, and as this is written weighs about two tons. A rhinoceros kept captive in the Calcutta Zoo for many years was said to have reached the enormous weight of four and a quarter tons.

CHAPTER VI

THE UNGULATES OR HOOFED ANIMALS

DESPITE their great differences in external appearance, the deer and the antelope familes are included by naturalists in the same zoological order as the hippopotamus and rhinoceros. All are ungulates or hoofed animals. Equally amazing to most visitors at the zoo is the statement that both deer and antelope are generally regarded by those who know them well as dangerous beasts to handle, particularly the buck deer with full-grown sets of annually renewed antlers. Even the comparatively young of some species can prove difficult to handle.

I learned this lesson many years ago when I was commissioned to capture a live moose in the woods of Maine and transport it to Boston. After a search I succeeded in locating a fine young bull, about six or seven months old, that as a baby had lost his mother and walked boldly into a lumber camp on the shore of Moosehead Lake in search of food. The men of the camp became sufficiently attached to him to place food daily where he could find it. Soon he became quite friendly. By the time I had arrived he was easy to capture, although he stood over four feet in height. For a few days we fed him on vegetables and grain in a small shed.

At first he rather disliked the idea of going in for it, but after missing his usual rations for a few days he apparently decided to take the chance. Finally he became so accustomed to it that we decided the time had come to lock him in and build a crate. This crate was made of the butts of small trees, with a few nails but plenty of lashing. When completed with a sliding door in the back, the door of the shed was quietly opened and the end of the crate placed in front of the exit. But the moose declined to enter his new home. I asked for volunteers to drive him into the crate, but no one seemed anxious to share the small shed with him. Finally I made the attempt myself. Knowing how effectively even young moose can use their sharp hoofs, I looked around for some protection for myself, finally discovering an old door that lay inside the building. With this shield held in front of me I approached slowly. Suddenly, while I was still at what seemed a safe distance, the captive let fly both hind legs like a mule. His hoofs struck the door with enough force to knock me down. I arose and again advanced very cautiously, bracing the door before me in preparation for another attack. As I came closer there was another exhibition of kicking, with no real damage to either the moose or me. Slowly, then, I drove him into the crate, and the sliding door was closed.

As soon as the animal found himself trapped, his struggles were terrific. For a while the crate bent and threatened to overturn, but eventually the youngster calmed down and thereafter was tame and friendly. Throughout his long journey by hand-sled, raft, steamer, and train to Boston, he showed no signs of fear or annoyance.

Had the animal been more fully developed my experience would have been far more serious. The American moose (called in Europe the elk) is the largest member of the deer family, living or extinct. Its flat, palm-like antlers are massive and have a tremendous spread. The animal is found in the northern part of the United States and Canada from Maine to Alaska. I have hunted moose in northern Maine and have always felt there is no more inspiring and imposing sight than a full-grown bull in its prime. An incident which still lingers in my memory was the sight many years ago of a great bull moose with an antler spread of fifty-eight inches which strode suddenly through long bog grass and bushes to the end of an open point looking out into the river not fifty yards from me, and stood poised in silhouette against the beautifully coloured background of the setting sun. I have seen many specimens since, but none so impressive as this.

Often it is difficult to convince visitors at the zoo that the antlers of giant moose and American elk are shed every year close to the head and entirely new sets grown in a season. This is true, however, of nearly all members of the deer family. In this country the native deer usually shed their antlers in the late winter or early spring. By the middle or last of October the new set is entirely grown, the velvet rubbed off, and the antlers polished. From that time on, the buck is a dangerous adversary. Shortly after the shedding of the old antlers, the new set starts. First velvety knobs appear close to the head. These grow rapidly, and soon the prongs of the antlers shoot out. After they are full-grown and hardened, the velvet-like skin covering them peels off, and it is then that the animal rubs them against trees and bushes to clean off the remaining skin. This rubbing also gives colour to the antlers, turning them to a brownish grey, with a deeper brown at the base where the dust of the bark gathers. They become dark or light in colour according to the tree upon which they are rubbed. I have seen deer with antlers almost black from rubbing on trees in a district ravished by forest fires.

Horns are quite different from antlers, and grow on most of the antelope, cattle animals, buffalo, and the like. Except in one instance they are never shed, but remain with the animal throughout its life. Horns have a bony core grown on to the skull, and once a horn is broken off it will bleed freely and never grow out again. The one species that does shed its horns is the American antelope, or prong-horn. Its horns, with a true bony core, are not, however, shed like the deer's antlers, which come off clean at the head, but fall because of a degeneration at the base. When new horns have developed under the old, the shell which was really the old horns is pushed off. These animals are native to the western part of the United States, where years ago they roamed the plains in large herds. To-day they have become scarce, only a few existing in small, scattered bands.

The shedding of deer antlers is another of Nature's wise provisions, since it immediately precedes the season for the birth of the young. A buck without antlers hardly dares to face an enraged female's sharp hoofs, and thus she is well able to protect her young from injury by him. The young of nearly all the round-horned deer are spotted at birth. This protective colouration is the only real safeguard the tiny animals have when they are hidden and left by the mother during the day.

Among the caribou, both males and females have antlers. These antlers are partly round and partly flat, generally long and branching. There are several species of the animal. In the Far North, from Greenland to Alaska, the Barren Ground caribou travel in large herds. In the spring and autumn huge herds of them, numbering thousands of individuals, gather to migrate. An immense herd of this sort is called by the natives *La Foula* (the throng). So many are contained in such herds that sometimes it takes several days for them to pass one point. The woodland caribou of the forests and prairie lands of New Brunswick, Nova Scotia, and Canada were once common in the State of Maine. Recently I had the privilege of reading from a diary belonging to a man named Aaron

Caper, who settled on Deer Island, Moosehead Lake, years ago. He wrote: "While at dinner I looked out of the window and saw a herd of caribou running across the ice of Moosehead Lake, followed by a pack of wolves." This is most interesting, as both wolves and caribou have been extirpated from Maine. The woodland caribou are generally found in small herds or individual families frequenting the deep woods and swamps during the summer and roaming the hills in winter.

On one trip to New Brunswick, hunting caribou for the Boston Society of Natural History, I started at Bathurst and made my way by canoe fifty miles up the Nipisiguit River, where I made a permanent camp for over two months before I succeeded in getting suitable specimens. For many days during the early autumn I sat on the mountain-side watching for caribou. It was warm weather, and no specimens were seen until the frost came. The first cold, frosty morning disclosed a number of them running about the hills like boys just let out of school. The majority appeared to be females and young, and it was not until I had spent three weeks in camp that I saw the first old bull with a good set of antlers.

The principal food of these interesting animals is the ground moss, which they are often obliged to dig from beneath a blanket of deep snow. Their eyesight is rather poor, but their power of detecting human beings by scent is most acute. From the leeward one can approach to within a short distance, but if he comes from the windward side the caribou will detect a hunter long before he is within rifle range, and flee. Once startled, they may run for many miles before stopping again to feed. Their heavy coats of hair are of a light-grey colour, turning to white around the neck. Few caribou are seen in zoological gardens, as they do not thrive in captivity.

The largest of the round-horned deer are the American elk or wapiti, which roam through the mountains and plains of the West. In captivity they are unusually dangerous, especially the bulls with full-grown sets of antlers, which will defy anything living, including man. After their antlers are shed, however, they become docile. As has been said, nearly all deer are dangerous; even the smaller varieties are liable to attack man. But when a bull elk, with his gigantic antlers and enormous strength, attacks, he does so with intent to kill, and unless help is immediately available he will succeed. In numerous instances keepers in zoos have been killed by these animals during the rutting season.

They seem friendly enough to eat out of one's hand, and then suddenly turn into vicious beasts, stabbing with their sharply pointed antlers or cutting with their powerful hoofs. Like all deer, they are the more dangerous because one not acquainted with them would hardly expect attack by such a gentle-looking and mild-eyed animal. That is why I say that a tame lion is far less dangerous than the so-called tame deer, especially during the season when the deer's antlers are fully grown and hardened.

In the wild, deer seldom attack. I have hunted the white-tailed deer in the woods of northern Maine for many years, and have yet to see one attack even though wounded. They are really the most timid of all the wild game animals, and extremely wise and difficult to approach. At the first crack of a twig or the slightest scent of man they are off, seldom stopping to look back until at a safe distance.

The mountain sheep, of which there are a great number of different species, live in the high mountains in different parts of the world, and may readily be recognized by their circling horns. Of all the game animals I know, the mountain sheep are the boldest and sturdiest. They are also apparently the most reckless, making their way rapidly by almost unbelievable bounds over the most rugged and dangerous spots without fear. A frightened sheep will put hours of hard climbing for the hunter between himself and his foe within a very few minutes. During the summer these animals live on the mountain slope above the timber line, feeding on the flowers and grass that grow there. In winter they descend to a lower altitude. I have noticed that they generally select special wide shelves of rock where they rest and feed during the day. These shelves, high on the mountains, are chosen because they overlook an entire valley. One old ram that I observed lay on a point so well located that no one could approach from any direction without being detected.

Mountain sheep do not, as a rule, live well in captivity in the lower altitudes, although they have been kept and bred in the National Zoological Park at Washington, D.C. Their food is practically the same as that of the deer and antelope. The ground upon which they live must be free from grass and weeds, and they should have at least a few flat rocks on which to sharpen their hoofs.

The Rocky Mountain goats defy all theories of protective colouration, at least during the summer, as they are pure white and generally the most conspicuous thing in the landscape. They live amid the highest peaks, and, unlike the sheep, are easily approached and killed by hunters who have the strength and courage to attain those dizzy altitudes. While I was on a hunting trip in the Rockies in north-western Montana in 1907, these goats were very plentiful, and I had my first glimpse of them from the top of the Main Divide. Looking across the valley, I could see what looked to be pieces of white paper among the rocks, but through my glasses I identified the goats walking along almost sheer mountain-side. Later I came upon two old billies lying down on the top of a mountain, and was rather surprised to see them rise slowly and go off in a sort of stiff-legged trot. After travelling a short distance to a higher spot, they stopped and deliberately turned round to see if I were following. This they did several times before they disappeared down the mountain-side. As a rule, these animals do not live well in captivity in this part of the country, but there are exceptions. They are mild-mannered and trustworthy and make splendid exhibits in any zoo.

The Himalayan tahr is a species of goat common in captivity, as it is hardy and breeds freely. Because of their remarkable ability as jumpers and climbers these goats must be confined behind high fences.

One specimen in the Philadelphia Zoo leaped from the ground to the side of a nearby structure and from that on to the roof of one of the larger buildings, where it was found the next morning playing around the ridgepole.

Antelope may be either delicate and nervous or bold and vicious. To prevent accident, one must use every known precaution in handling them. This is especially true of newly arrived specimens.

The wily African buffalo, the most dangerous of all mammals in Africa, is famous for its strength and cunning, and is therefore one of the worst animals to deal with in captivity. Bold and fearless to the last degree, it must be carefully watched. These buffalo seldom make mad rushes at a foe, but wait cunningly until the opportunity arrives when they can do the most damage with the least danger to themselves. When enraged they make vicious charges, and sometimes strike the heavy bars of their enclosures with force enough to shake the entire building. Many hunters say that in Africa the buffalo is more feared than the lion. Often when a herd has been followed and annoyed for some time, an old bull will drop back in hiding until the hunters have passed, then make his attack from the rear. Most African buffalo in captivity were taken when young. They thrive well in zoological collections.

The giraffe is another ungulate, and, so far as my observation goes, is the most even-tempered of them all. The majority of giraffes in captivity are quite tame, although not always dependable. They can kick with terrific force, and because of their long legs they are a constant source of worry to keepers. Precautions must be taken to prevent their slipping in the cages, and their food boxes must be placed high up, never on the floor.

In 1875, when the Zoological Society of Philadelphia first opened the gates of the Philadelphia Zoo, giraffes were apparently plentiful and easy to secure, six specimens being exhibited at that time. At the present time there is no such collection in any zoo in America. They cost from five to six thousand dollars each.

Jim, the popular giraffe now in the Philadelphia Zoo, is one of the best, so far as disposition is concerned, that we have ever exhibited. He is as tame as a kitten, delights in being petted or fed with sugar lumps, and never shows any sign of fear or resentment.

In the wild, giraffes can go many days without drinking, owing to the fact that they browse on the leaves of trees in the early morning when foliage is heavy with dew. In captivity, however, they drink several times daily.

The handsome zebras, also members of this group, always attract great interest by reason of their beautiful striped coats. In Africa they roam in great herds on the plains and are the favourite food for lions. In captivity they are usually peaceful, but if aroused can become wild and vicious, administering terrific and accurately placed kicks as well as bites.

CHAPTER VII

RODENTS OR GNAWING ANIMALS

EARLY in February of each year a small furry animal of rather unprepossessing appearance becomes the centre of newspaper and public interest. He is the woodchuck, or groundhog, our best midwinter publicity agent. On February 2, reporters and photographers gather round the hole where he has dug in to hibernate for the winter, snap photographs, if he appears, and write columns of imaginary interviews with him.

This temporary fame is due to the tradition which maintains that the woodchuck comes out of his hole on the second day of February to look for his shadow. If the day is clear enough for him to see it, the old tale runs, six more weeks of winter weather may be expected. If it is too cloudy, then winter's back has been broken, and an early spring is due. The tradition has probably been fixed by the ancient Candlemas Day doggerel which in one form runs:

If Candlemas Day be cloudy and rain,
Winter has gone, not to come again,
If Candlemas Day is fair and bright,
Winter has taken another flight.

Woodchucks really do hibernate in cold climates, after first gorging themselves with food until they become enormously fat, and dragging leaves or foliage into their deep burrows. They remain in their cosy nests until a few warm days of early spring bring them forth, thin and hungry. They are, in fact, the only animals that really hibernate in captivity. Bears and others hibernate in the wild, but I know of no instance of their doing so in zoological collections. If a woodchuck is dug out of his hole in winter, he at first appears to be dead, but when taken into a warm place he quickly revives and renews his activities.

The woodchuck is a member of the order *Rodentia,* or gnawing animals, which includes squirrels, marmots, beavers, rats, mice, prairie dogs, hares, rabbits, porcupines, and many others. It is rather difficult to select the most interesting members of this large order, but to my mind the beaver comes first. It is the largest living rodent in North America, measuring sometimes as much as forty-four inches, with a broad, flat tail about nine inches long. Some specimens attain a weight of fifty pounds. The wonderful engineering feats of the beavers and their mechanical skill and reasoning powers are unequalled by any other animals. Many zoological gardens possess specimens, but, owing to the fact that most of their work is done in the night, they may seldom be seen except possibly at feeding-time.

It has been my good fortune to visit several beaver colonies in the wild to study and photograph the busy workers, and as I watched I was greatly impressed by their ability to think out ways and means of building their houses and dams capable of withstanding the ice and snow of winter and the freshets and floods of spring. All these forces must be considered and decided upon before they start building. Beavers sometimes travel for miles before they definitely decide upon a location with a stream that can be dammed up to make their ponds and with a sufficient supply of trees to be cut down for the winter food supply. They begin by cutting down and dragging in alder or other suitable bushes, then placing mud and stone in the stream to make it overflow the bank. The butt ends of the bushes are stuck in the mud below the dam, with the tops at an angle pointed upstream. More mud, then sticks or pieces of turf are added, until, as the dam grows, the water rises and forms a huge pond.

Sometimes a dam will exceed sixty feet in length. The ends are generally turned upstream, making it semicircular in form. The ponds thus formed are large and sometimes extend well back into the woods. When completed, a dam is strong enough for a man to walk on, and raises the pond to a sufficient height for the animals' needs. Beavers choose only the most secluded places for their colonies, as far as possible from the presence of man.

After the dam has been completed to the satisfaction of the animals, work is begun on the houses, which are usually placed far out in the centre of the pond. Built in much the same manner as the dam, these lodges, when finished, look like huge masses of sticks and mud. They are neatly built and large, some exceeding twelve feet in diameter. According to my observations, the houses are first built solid. Then the inside is dug out and the sticks cut off to form warm, comfortable interiors with the entrances under water. Shelves built on the sides are lined with chips for beds. Before the young appear, the female cuts out a shelf above her own which she lines with fine grass and small chips of wood about the size of toothpicks. Here the babies lie contentedly for the first few months, and as the interior is above high-water mark they remain warm and dry.

When entering his home, the beaver dives through the submerged doorway and comes up into the living-quarters. The roof of his house is not filled in tightly with mud. The sticks are left bare instead to assure small vents for the passage of fresh air. Sometimes when a beaver becomes old or is injured it will build a house for itself on the edge of the pond with one entrance under water and one from the shore. In this way it is enabled readily to secure fresh food, even if the winter's supply has been depleted. I once found a house of this kind containing one beaver that had lost a leg, probably in a trap.

Beavers fell many trees with their long, chisel-like teeth, taking out huge chips at every bite. The muscles of their jaws are extremely well developed, enabling them to cut through a tree in a short time. They work round and round the tree, until only the heart remains, and then by a few cleverly placed cuts the tree is made to topple in the chosen direction, generally toward the water. Branches are then lopped off and cut into small logs, which are dragged to the front of the house, where they are sunk and fastened by burying the ends in the mud at the bottom. The animals, as has been said, store a supply of food that will last them throughout the cold weather. When hungry they dive through the under-water door, select a few juicy food sticks, and take them into their homes to be eaten at leisure. When food trees become scarce along their pond, the beavers travel deeper into the woods for their cutting operations, sometimes digging long canals along which they float the logs down to the pond. These canals are generally about two feet wide and sometimes extend for considerable distances.

As a rule, beavers do most of their work at night, except in locations where they are entirely undisturbed by man. Once, in Maine, I visited a colony a long distance from any settlement or public road. There the beavers were quite tame, cutting trees, dragging in logs, and performing their other activities without fear during the entire day.

When a beaver dam is broken, the animals realize it immediately by observing the fallen water in the pond, and one will swim out to make the necessary repairs. If others notice that the water is still falling they will hasten to assist in the repair work. Sometimes, in case of a bad leak, an entire colony of twenty-five or more will get on the job, continuing their labours until the break has been closed. This practice, known to fur trappers, is often utilized by them to swell the number of their pelts. The men will purposely break the dam and, as the beavers come out one at a time to repair it, will sit near by and kill them until the entire colony has been destroyed. To me it has always seemed a pity that the intelligent, harmless, and busy little animals must be slaughtered solely for the high price set upon their skins. They are not, to my mind, protected as they should be. It has been said that in building their ponds the animals cause the water to back up into the woods, thereby killing many trees. While it is true that at times trees are killed in this way, I think their numbers are small when compared with the great quantities which lumbermen themselves cut and leave to rot because they are in the way of some particular trees they want. Often trees are cut down simply to make a wide roadway through the forests to haul out lumber.

I hope some day to see laws enforced which will protect beavers fully. In zoological gardens the animals are allowed to build their dams and houses, given plenty of good food, and live out their allotted time in peace and comfort.

The common muskrat of North America, like the beaver, builds houses of sticks and mud in marshy places where it lives during the winter. Some observers assume to be able to determine the weather by such houses, predicting harsh or mild winters according to the thickness of the walls. In summer the muskrat live in holes in the muddy banks of rivers and ponds. They are much sought after because of their pelts, which are used extensively in the manufacture of different kinds of commercial furs. Generally they are trapped. Sometimes advantage is taken of their habit of swimming under the ice, coming to the top occasionally for breath. At such times a bubble is blown beneath the ice. Hunters then tap the ice over them hard enough to break this bubble of air. This causes them to smother, when they can easily be removed by cutting holes in the ice. Full-grown muskrats are about eighteen or twenty inches long and emit a musky odour. Plentiful in streams and ponds, they are, however, most unsatisfactory in captivity.

Another member of this family is the coypu cat of South America, which is somewhat larger than the muskrat but lighter in colour. Its pelt is known in the fur trade as nutria, and is of considerable value.

Wild mice of many different varieties exist in North America, but they are seldom seen in zoological gardens. One of the most common throughout the northern part of the United States and southern Canada is the white-footed mouse. These are beautiful little creatures, coloured a light greyish buff on the back and pure white beneath, and are often seen in the woods about camps. They are good swimmers and active climbers and feed principally upon seeds. The jumping mouse, with its long kangaroo legs, is a less common species.

Another interesting member of the order of rodents is the whistling marmot, somewhat similar to the woodchuck. Once in the north-western Rockies I came suddenly upon a large colony of these animals. Hundreds of them were running about on the rocks, and one very large specimen was perched upon a projecting ledge overlooking the entire valley. This was the sentinel. As I approached, he gave a shrill whistle, whereupon every member of the band disappeared into its burrow. It required considerable patience to wait in hiding for what seemed like hours before the marmots again appeared in response to two sharp whistles by the sentinel. One by one they emerged cautiously until they felt safe from intruders, and I was rewarded by an excellent opportunity to observe them. I have never yet seen these animals in captivity.

That common little denizen of the western plains known as the prairie dog is a very interesting member of this family. Not half as large as the woodchuck, its habits are similar. These animals dislike solitude, preferring to live together in large colonies. They are great favourites in the zoo, where their cheerful and social manners endear them to all visitors. In some sections of the South-west they are considered pests by reason of their practice of digging deep burrows into which horses have stumbled and broken their legs. Prairie dogs burrow deep into the ground and around the entrance of their holes pile up large quantities of dirt and mud which they tamp down tightly with their noses. This prevents water from running in after heavy rains, and also offers them a high place to sit and observe the surrounding country. They are very quick, disappearing into their burrows at the least sound. Soon, however, they come up again to see what is going on. Many people believe that prairie dogs live happily in the same holes with rattlesnakes and burrowing owls. This is, of course, untrue, as a rattlesnake will kill and make a meal of the small prairie dogs. Possibly the story has grown from the facts that rattlesnakes sometimes go into the holes to devour the young, and burrowing owls often use the deserted holes rather than dig others for themselves.

Another interesting rodent, which unfortunately is seldom seen in captivity, is the little chief hare or pika. Members of this family are about the size of very young rabbits, but have short rounded ears. Far up among the shale and trap rock of the Rocky Mountains they make their homes, building under the rocks and feeding upon the tiny plants and grasses that grow there. They are difficult to approach, but if one has sufficient patience to sit down and wait they will finally come out of their hiding-places and feed, sometimes within a few feet. In colour they match the rocks closely, and it is difficult to see them unless they are moving. I made my first acquaintance with them one morning while crossing a rocky section of the mountains, intent on hunting goats. Suddenly I heard them calling in sharp, insect-like voices from among the rocks. I waited and was finally rewarded by the sight of several; one came to within a few feet of me, and after pulling up a small plant proceeded to devour it, starting at the root. The animals are sometimes called "little haymakers of the hills" because of their habit of pulling up grasses and placing them when dry beneath projecting rocks for a winter food supply. Often such piles contain a bushel or more of neatly made hay.

Many persons are familiar with the Northern hares. Like numerous other animals of the Northern countries, these hares change colour at different seasons of the year to match the ground on which they live. In winter the colour is pure white and matches the snow, but in summer it changes to light brown, corresponding with the ground. The common rabbits or cottontails do not change colour, but remain brown throughout the entire year. When pursued by their enemies, they run for long distances or dive into holes in the ground for shelter, while the hares, depending upon their protective colouration, lie beneath bushes close to the ground. When startled, however, they are very swift runners.

The grey squirrels, so common in most city parks, are allowed to run wild in the Philadelphia Zoo. They build their nests in hollow trees precisely as they do in the woods. More than one hundred and seventy species and sub-species of squirrels are found in the United States alone, but the grey squirrel is the best known. The red squirrel is also a common species of rather more Northern distribution. Its pleasing little calls and explosive notes are among the charms of the North woods. These animals are quite friendly, and live on the seeds of trees and on pine cones. They are fond of the deep woods and secluded spots away from settlements of man. Wherever one finds the red squirrel, the grey is seldom seen, since the two do not get along well together. The reds annoy the greys with their explosive barks and rattles to such an extent that the greys soon seek other quarters.

The flying squirrels are the only squirrels in the United States with membranes from the front to the hind legs. When spread, the membrane forms a wing that acts like a glider and enables the animals to make wonderful long leaps or flights from tree to tree. When nearing the ground, they describe an upward curve and are carried to the side of another tree some distance away, where they alight gently. All squirrels have the ability to jump or fall from great heights without injury to themselves. Once I watched a grey squirrel slip from the roof of a high building and fall to the ground below.

In the descent, the feet and tail kept working up and down like a bird's wings, holding the animal in an upright position and making it possible for him to land gently and right side up without injury.

Porcupines are among the more stupid and clumsy rodents. There are many varieties, the most common being the Canada porcupine, familiar to anyone who has visited the deep woods of northern Maine or Canada. Generally these animals cling closely to the trees, since on the ground they move so slowly that they are easily captured. I shall always remember one that I saw while on a moose hunt in the woods of Maine. It was hanging across a branch, apparently asleep. After watching it for some time, I went on up the road and was gone for several hours. Upon my return, the animal still lay in the same position.

I am often asked whether it is possible for porcupines to shoot their quills. My answer is no, but that they are able to loosen the quills so that after coming into contact with these spiny creatures the unfortunate victim generally finds itself stuck full of the sharp points. Each quill is barbed at the end and, if not immediately pulled out, will work into the flesh with every slight movement. When food is scarce, wildcats, lynxes, and other carnivorous animals will often attack porcupines, with the result that their heads and mouths become filled with these sharp quills. Many animals starve to death after this experience, as their heads and paws become so inflamed and swollen that it is impossible for them to eat.

The Canadian porcupine is hardy in captivity, sleeping most of the time in the trees but coming down for food, which consists of bread, carrots, sweet potatoes, and sweet corn in season. The Brazilian tree porcupine is almost always present in our Philadelphia collection. It is not as stout as the Canadian variety, but has many more bristling quills. It is remarkable, too, for its long prehensile tail, with which it can cling or hang to trees or branches.

Another strange member of the family is the brush-tailed porcupine from West Africa. Its peculiarity is a brush-like appendage on the top of its tail, resembling crimped white tissue paper. It is sparsely covered with hair, and its long quills, while not particularly plentiful, are both prominent and formidable.

CHAPTER VIII

INSECT EATERS AND TOOTHLESS ANIMALS

IF, when walking some day through the woods, you hear a very slight rustling on the ground, see a leaf flick over, and catch a quick glimpse of something moving beneath it, you have probably intruded on a shrew. The interesting and retiring family *Insectivora* (which includes also the moles and hedgehogs) contains something like thirty-five species in North America alone. Unlike moles, however, the shrews occasionally emerge above the ground, and are then easily caught. They are seldom seen, because of their protective colouration. There are occasions when, if one sits quietly for some time, these tiny creatures come out, and at such times they show little fear of man.

One day while I was eating my lunch on a sunny bank along the Ipswich River in Massachusetts, I threw away a small bone. Later I saw the bone move slightly. Leaning over to study this phenomenon, my gaze fell on a tiny shrew. Although within a few feet, he gave me no attention whatever. After he had eaten his fill he tried with all his might to pull the bone into his burrow, but it was too large, so he contented himself by pulling it partly in and covering the remainder with leaves. Several times afterward I visited this spot, carrying bones for the shrew, and never failed to see him. Finally, he became so tame that I could pick leaves away from within three inches of him. It was an interesting experience, and the only time I ever saw a live shrew in its natural habitat.

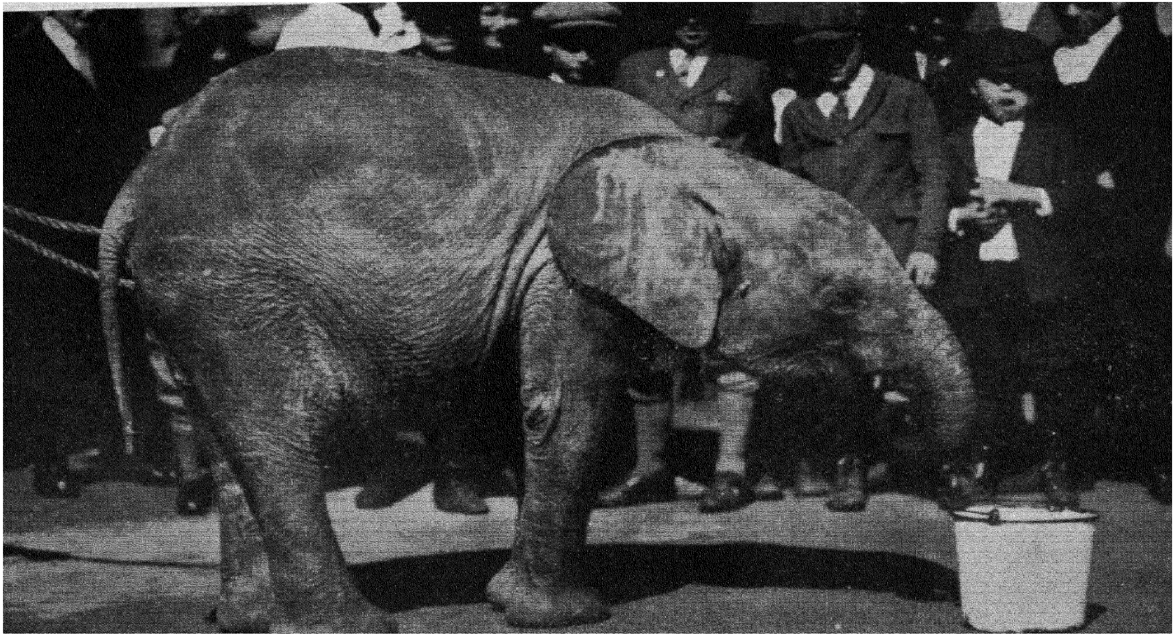
The mole family also contains several different species, the star-nosed being the one best known to farmers. These small creatures spend most of their time underground, digging long tunnels in the fields and on lawns, just beneath the surface, and feeding on worms and insects as they go along. The star-nosed mole is very common in the northern part of our country, and is so called because of the remarkable appendage on the end of its nose. The burrow of the common mole, more familiar in the vicinity of Philadelphia, contains sometimes over one hundred feet of tunnels.

A larger member of the family of insectivorous animals is the hedgehog of Europe, which is about the size of a young rabbit. Of a yellowish-brown colour, its coat is composed of short and very sharp spines or quills. It has the power to roll itself into a ball with head and feet tucked away so that only a very bold dog or fox will attack it. The hedgehog is about the only insect-eating animal that thrives well in captivity. Its diet in the zoo consists of small portions of finely ground raw meat, fruit, and live meal worms. Because of its sharp spines this animal is sometimes confused with the American porcupine, but they represent entirely different families.

The *Edentata,* or toothless animals, constitute quite a different order from the *Insectivora,* although many of them include insects in their diet. Among them are the ant-eaters, sloths, and armadillos. With few exceptions, the latter are found in South America, once the home of the now extinct giant glypton, an armadillo that grew to the length of five and a half feet and had a high, rounded shell similar to that of a huge tortoise in shape. The present-day armadillo, however, is a small creature with several armour-like plates covering its back. There are different species, all of which make their homes in burrows in the ground. The most common of these is the nine-banded variety found in Texas, Arizona, and as far south as Paraguay. Very often this species is exhibited in zoos, as the animals are plentiful in their native habitat, easily secured, and can be purchased at low prices. They are really not objectionable pets, as they have no front teeth, and their claws are fit only for digging. All animals have some means of protection from their enemies. The armadillo's defence consists in rolling itself into a complete ball entirely covered by armour-like plates. Its food in captivity consists of finely ground raw meat with eggs.

Another representative of this order is the giant ant-eater, a toothless mammal which feeds in the wild by running its long, sticky tongue into a swarm of ants and then drawing it quickly back into the mouth covered with these dainty morsels. In captivity the ant-eaters are given eggs and milk beaten up together, with a small portion of very finely ground raw meat stirred into it. They attack this food also with the tongue, precisely as they would a colony of ants.

They are truly curious animals to look upon, suggesting miniature prehistoric monsters. The heads and noses are long and sharply pointed. They have large, strong forelegs armed with formidable claws used to great advantage in defence and in knocking down anthills in search of food. Long, coarse hair covers their bodies. On the tail



PIGMY AFRICAN ELEPHANT

A species known only in the Cameroons ; their height when fully grown is not much over seven feet.

this hair grows to a great length, forming a huge fan, used to brush away insects. When sleeping, the ant-eater places his nose between his forelegs and brings the huge, fan-like tail forward to cover the body. So well is the animal then hidden, and so closely does it resemble a pile of dead brushwood, that it is most difficult to see. The long claws are always sharp and ready for business. In walking they are turned in such a manner that the sharp-pointed ends do not touch the ground and become dulled.

A much smaller species of ant-eater, called the tamandua, also inhabits South America. It has a hairless prehensile tail, used to good advantage in climbing. Otherwise it has the same general characteristics, form, and habits of the giant ant-eater, except in colouration. The giant ant-eater is approximately six feet long, while the tamandua seldom exceeds three and a half feet.

Although included among the toothless animals, the sloths have five pairs of teeth in the upper jaw and four pairs in the lower. They are probably the most helpless of mammals, as they cannot fight, hide, or run. Nor do they wear any protective armour. They are not strong enough to dig holes in the ground for themselves, and are too large to find holes in trees in which to hide. They appear too tired to walk upright or upon all-fours, and spend their time moving slowly about in the trees, hanging upside down by all-fours. A sloth's only defence is its protective colouration. When an enemy approaches, it hangs motionless in the tree, trusting to luck not to be seen. Observers have estimated that the swiftest of sloths would be able, if nothing were in his way, to travel about half-a-mile in twenty-four hours. Sloths thrive fairly well in captivity, but as exhibits they are disappointing, for despite noise, excitement, or numerous attempts to stir them up, they will hang placidly without motion. Their food at the zoo consists of leaves of various kinds, bananas, cut-up vegetables, and boiled rice. Frequently it must be hung in branches of trees.

Another class of animals approaching in rarity the sloths and ant-eaters are those known as the *Effodientia* or diggers. This contains but seven species, all confined to India and Africa. At one time they were classed with the ant-eaters and sloths, but a number of years ago they were separated and placed in an order by themselves. The order contains the pangolons of India and Africa and the aardvarks (earth pigs) of South Africa. The giant pangolons are extremely hard to transport and are seldom, if ever, seen in zoological collections. While toothless and unable to fight, they continue to live on this earth of ours in safety while surrounded by countless savage enemies. This is almost entirely due to the fact that they wear a strong armour of heavy scales from the tip of the nose to the end of the tail. Large and strong, they measure when full-grown about six feet in length. It has been said that when one of these animals rolls up in its armour the combined strength of at least three men is required to unroll it. Their feeding habits resemble those of the ant-eaters.

In South Africa live the peculiarly shaped animals called by the Boers the aardvarks, or earth pigs. They are large, heavy animals with long snouts turned up like those of pigs, and bodies sparsely covered with short, brownish hair. In captivity an aardvark is docile, but must be kept in an enclosure from which he cannot escape by digging. A demonstration of the animal's rapid digging occurred in the Philadelphia Zoo, where during the night our aardvark guest was kept in an inside cage with a cement bottom, and during the day in a large-sized yard. During a hot spell it was decided to leave the door open to the outside enclosure so he might go out at will. One morning he was reported missing. We found a large hole in the corner of his outside cage, but no sign of the animal. Finally, after failing to locate him elsewhere in the garden, I had the men dig him out. They found the aardvark snugly sleeping at the end of the burrow at least eight feet from the starting-point. The combined efforts of three men were required to pull him to the surface.

In the wild, the aardvark lives principally on ants. In captivity the food is much the same as that of the ant-eaters. Since the animals do not thrive in zoos in this part of the country, they are seldom seen here.

CHAPTER IX

MARSUPIALS AND MONOTREMES

To most zoo visitors, the word marsupial suggests kangaroos, wombats, or other strange beasts of Australia. Yet in virtually every zoological garden may be found a native American animal which is truly marsupial. This is the common opossum, which, like the kangaroo, carries its young in a pouch. It is the only representative of the order found in this country.

Next to their popularity as a table delicacy in many parts of the South, these animals are best known for their habit of "playing 'possum". The practice is frequently successful in permitting escape after capture. When cornered, opossums will fall over as if dead and allow themselves to be poked and even picked up without showing a sign of life. As soon as the danger has passed they will jump up and run. They are rather slow and dull-looking creatures, but can move quickly if necessary. As a rule opossums build their nests among the roots of trees in difficult places for either men or dogs to dig them out. A mother opossum, moving along with eight or ten young ones hanging to her back, is a most interesting sight. The young are very small, and not until they are four or five weeks old do they venture any distance from the mother's protection. For an entire season they never go far enough to be out of her reach when danger threatens. All opossums have very wide and powerful jaws, set with strong formidable teeth as weapons. They will eat with equal relish fruits, vegetables, berries, insects, nuts, eggs, young birds, and roots; in fact, almost anything they can find. In captivity they receive ground meat, vegetables, and bananas. Among themselves they are notable fighters. Usually they start off snarling at each other. Then they get hold of each other's jaws and twist until one finishes with a broken jaw-bone.

The murine opossum, another member of this family, comes from South America. It is very small—not much larger, in fact, than a small rat. A number of specimens acquired by the Philadelphia Zoo had been found hidden in bunches of freshly imported bananas.

Kangaroos and wallabies are natives of Australia, Tasmania, and New Guinea. The most remarkable feature of these animals is their extremely long and powerful legs. They have also heavy, strong tails, used, when sitting, as a means of balance. In running they use their hind legs exclusively, moving at a rapid gait by a series of jumps. When in no particular hurry they spring eight or ten feet at a leap. When frightened, however, their jumps are said to lengthen to twenty feet or more, assuring great speed. On open ground, they outdistance the fleetest dog, and can keep up this killing pace for hours, clearing with ease obstacles eight feet or more in height.

The largest of all kangaroos is the male red kangaroo, which sometimes attains a height of seven feet. Although generally timid, a cornered or wounded kangaroo is dangerous to approach, as a blow from its sharp-nailed hind feet can easily tear open either dog or man.

At birth, kangaroos are hairless, almost shapeless little creatures measuring from one to three inches in length. As soon as they are born they make their way unaided to the mother's pouch, where they attach themselves to the mammæ, and the mother's milk is injected into them automatically. Here they hang and grow until large and strong enough to leave the pouch. For months, however, they will remain out only a short time, jumping back into the pouch to sleep or feed, or at the first sign of danger.

There are many different species of kangaroos, all living and feeding upon the ground, with the exception of the odd tree kangaroos, which readily climb trees, sometimes to the topmost branches, and feed on leaves. They are much smaller than the others, with longer forelegs. In captivity most kangaroos live on a diet of bread, cut vegetables, and hay.

An interesting and vicious species of this order is the Tasmanian devil. In size this animal approaches the badger, but is more heavily and strongly built and much more bearlike in form and body, snarling, growling, and fighting during most of the waking hours. Even in sleep it will twitch and growl. Its jaws are like steel traps and are tenacious as those of a bulldog.

A rare marsupial is the Tasmanian wolf, a long, lean mammal approximating in size the common timber wolf of our country. Striped for nearly the entire length of body, it is sometimes called the zebra wolf. The wombat, another member of this order, is entirely different and far more gentle in disposition. It is a rather large, dark brown, and slow-moving animal, resembling in form an overgrown woodchuck. In captivity it spends most of the day tightly curled up in the corner of the cage, paying no attention to visitors and seldom moving unless disturbed.

One of the prettiest of the small mammals is the tiny koala, sometimes called the native bear of Australia. It is almost an exact likeness of the so-called teddy-bear toy. Koalas spend most of their time in trees; hence their feet are particularly well adapted to clasping the branches. I know of no more attractive sight than one of these fuzzy little animals moving slowly in the branches of a tree with a tiny baby clinging tightly to its back. On the forefeet of the animals the two innermost toes are directly opposed to the three outer, and act as thumbs. This arrangement of the toes gives the animal wonderful grasping powers, and aids it in climbing, but causes an awkward gait in walking. Koalas are light grey in colour, like our common grey squirrel in its winter coat. Unfortunately, they do not live well in this country and are extremely rare as zoological exhibits.

The *Monotremata,* or egg-laying mammals, represent the last order of mammals, which contains only two families, the echidna and the duck-billed platypus. Both these mammals lay eggs from which the young are hatched, and both suckle their young. They are regarded as a kind of connecting link between mammals and birds, and are the only mammals whose young are hatched from eggs.

The platypus is a small animal, both in looks and in habits resembling our common muskrat, except that it has a flattened tail like the beaver, and the adult has hair on the upper side only. The head is quite small, shaped somewhat like that of a duck, with a large flat bill. Like the muskrat, the platypus lives in the water most of the time and digs long, wandering tunnels containing many dry chambers in which to sleep during the day. Each hind foot is armed with long sharp claws reputed to be attached to a poison sac which enables the animals to inject venom into their enemies. Whether this be true or not I cannot say, but I do know that the animals can inflict painful and severe wounds with their claws. Their food in captivity consists of freshwater shrimps and earthworms, which they consume in vast numbers. The only specimen ever landed alive in America was brought in by Mr. Ellis S. Joseph, a collector, who kept eight of the animals in captivity in Australia for many months to accustom them to zoo life and to the food they would receive. When he thought the time had arrived to start the journey to America, he arranged specially constructed boxes, as near as possible to their native burrows. Each box contained a long, dark runway, pools of water, and bedding. At each entrance a rubber ring was placed, so that when the animal entered the box the water of the pond was squeezed from its coat. This kept the boxes dry. Mr. Joseph started from Australia with eight of these rare animals, but despite their care en route they died off until only one reached America alive. Purchased by the New York Zoological Society, it was placed on exhibition for one hour a day only, and drew great crowds. At the conclusion of its sixty minutes' appearance it was returned to its nest to rest, disappointing many late visitors. Despite this care, it died after a few months.

The echidna, the only other egg-laying mammal, is quite different from the duck-billed platypus. It is completely covered with short, sharp quills like the procupine, and for this reason is sometimes called the porcupine ant-eater. About a foot in length, these animals live in burrows in the ground, feeding principally on insects, especially ants. Their short bills or beaks, unlike those of the platypus, are round and two inches in length, with holes at the ends through which enormously long tongues can be extended. The food clings to the animal's tongue and is pulled into the mouth, as with the ant-eater. The ant-eater, however, relies on a sticky substance on its tongue to which the insects adhere. The echidna hooks its prey on sharp, incurved spines with which its tongue and mouth are lined. These animals are seldom seen in captivity, for two reasons: first, they are difficult to secure; and, second, they generally live only a short time. If they do live, they need a dark hiding-place during the day, as it is only at dusk that they emerge for their food.

A remarkable example of what can be done with these rare animals is apparent at the Philadelphia Zoo, which possesses a specimen that has lived in the small mammal house for more than twenty-seven years and is still strong and healthy. The animal is never disturbed, not even for photographs. Rolled up in a dark corner, it remains in its secluded box asleep on clean earth during the entire day. It would be extremely difficult to pull or coax it out until just at dusk, when it slowly wanders forth to partake of its one daily meal. This consists of an egg broken into one pan and a pint of milk poured into another. It goes from one to the other until it has fully consumed the food. If the egg and milk are mixed in the one pan they may be rejected. When rolled up in the corner of its box, the echidna looks like a round, spiny ball. It holds tightly to the floor, partly by suction.

CHAPTER X

SEA DWELLERS

FEEDING-TIME is always the hour of great interest to visitors at the zoo. And probably no specimens enjoy greater popularity at this time than the sea lions or California hair seals, always among the most graceful and attractive exhibits.

The diet of sea lions in captivity consists entirely of small fish. Twice daily this food is thrown to them, usually before appreciative audiences who delight in watching them catch each fish, then throw it into the air several times until the head goes into the sea lion's mouth first. Sea lions always swallow fish in this way. They have remarkable digestive organs, capable of assimilating bones and all. It is quite necessary that all bones be digested, as the intestinal tract of the sea lion is about eighty feet in length and not much thicker than a man's little finger.

Sea lions belong to the order *Pinnipedia*, which includes seals, sea elephants, and walruses. All are mammals that live almost entirely in the water. Other than the sea lions, however, they are seldom seen in zoological collections. The sea lions are found along the coast of southern California, and are the species so commonly seen not only in zoos but on the stage and in the circus, where their fine sense of equilibrium permits them to perform marvellous feats of balancing and juggling. They are able to catch and balance large round balls on the extreme ends of their noses and to carry them up and down ladders. All have marked intelligence and are easily taught.

Seals, of which there are many species, are less common in captivity. They seldom live long when captured. Perhaps the most familiar along the Atlantic Coast is the harbour seal, easily recognized by its light-grey coat thickly spotted with black, and its short flippers. On land it does not use the flippers at all, but propels itself along the beach by a series of jumping movements.

The seal yielding the beautiful fur so greatly in demand for coats is the fur seal, which makes its home on and around the Pribilof Islands in the Bering Sea. These seals spend much of their lives far from land. At one time they were in danger of becoming extinct, as they were killed at the rate of one hundred thousand or more yearly. I believe they are again increasing in number as a result of protective regulations.

The walrus is a seal-like animal of enormous size, a full-grown specimen sometimes weighing more than a ton. Walruses usually travel in large herds in the Far Northern waters, where they are killed by the Eskimos for their meat, blubber, and skins, which these people use for food and clothing. They fight almost constantly among themselves. Only a few have ever reached this country alive. These were practically all babies, and lived but a short time. One that arrived at the New York Zoo several years ago was fed almost entirely on clams, first taken out of the shell. This was a most expensive diet, keeping seven men busy shelling clams to satisfy that enormous appetite. In their natural habitat, walruses live on aquatic plants and shellfish dug from the bottom of shallow bays with their long and powerful tusks.

The huge elephant seal, or sea elephant, is the largest member of this order, not even excluding the walrus. Its name is derived from an appendage on the nose of the male resembling a short proboscis, which can be expanded, dilated, and twisted round in much the same way as an elephant's. The end of the proboscis or trunk is penetrated by oblique nostrils. Males attain a length of from twenty to twenty-two feet, but the females are smaller, seldom measuring over sixteen feet. The young often measure six feet at birth. Generally only one is born, but twins are not unknown. More than two hundred gallons of oil, it is said, have been obtained from one full-grown specimen. Elephant seals inhabit the islands of the South Atlantic, Pacific, and Indian Oceans, and the Antarctic Sea. They live well in captivity. When they stand almost erect (one of their tricks), the heads are so high they can hardly be reached by a man on the ground. The great expense attached to purchasing and transporting these huge animals, together with the high cost of feeding them, has been the chief reason for their absence from some of the larger zoos. The St. Louis Zoo has purchased a number of specimens, however, and they have attracted large crowds, especially at feeding-time.

Among the many other members of the seal family are the harp seal, ribbon seal, hooded seal, and bearded seal, all of the North Atlantic. The harp seal, I believe, is the most beautiful. It is white, with black patches on the side and black marks over the eyes and cheeks. The markings on the side suggests the shape of the harp, whence its name.

Whales and porpoises belong to a quite different order, the *Cetacea,* scarcely ever seen in captivity. Only those fortunate enough to be able to take ocean voyages ever see large whales alive, and then only a part of their enormous bodies appears above water. Living wholly in the water, they are continually confused with fishes, to which they are in no way related. These, the largest creatures that ever inhabited the earth, are true mammals, giving birth to living young and nursing them precisely as do cows, horses, or other land mammals. Their skin is of a shining greyish black and as smooth as glass.

The baleen whales are easily recognized by the presence of the so-called whalebone, which is really a fringe around the mouth. When the whale darts into a school of fish to scoop up a mouthful, this fringe enables it to expel the water and at the same time retain all the fish. It acts, in other words, as a strainer.

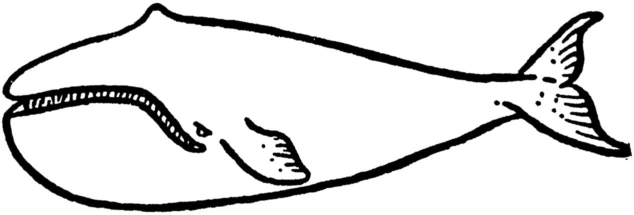
The sulphur-bottom whale, included in this group, is the greatest of all whales, with a total length of from seventy to ninety feet. It is a pelagic species, seen only well off-shore.

The right whale is another of large size, averaging from fifty to sixty feet. The head accounts for nearly one-third its entire length. This enormous species inhabits the North Atlantic and is valuable for its oil and whalebone. Seamon, in *Marine Mammals and Whales,* says that a right whale sometimes yields 150 barrels of oil and 1,550 pounds of whalebone.

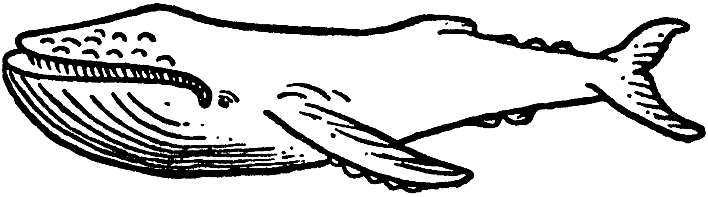
All whales breathe air and must come to the surface often or smother. When warm breath is exhaled a spurt of vapour and water is sent into the air. It is the sight of this from a whaling-ship that causes the lookout to start the men into action with the cry of "There she blows!"

The sperm whale, so valuable for sperm oil, is one of the largest of whales. A full-grown specimen will measure from sixty to eighty feet. The lower jaw is very narrow and is armed with twenty-two to twenty-four sharp, powerful teeth.

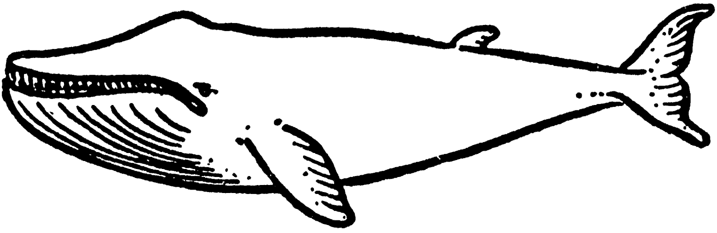
The grampus, sometimes called cow fish, dolphins of several varieties, common harbour porpoises or puffing pigs, and others are members of this family. Several species of porpoises are often seen in our harbours and along the seacoast. Generally they travel in schools and come to the surface at regular intervals, rolling over so that they appear



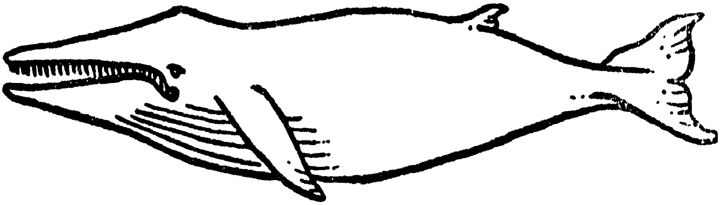
RIGHT WHALE LENGTH 50 TO 60 FT.



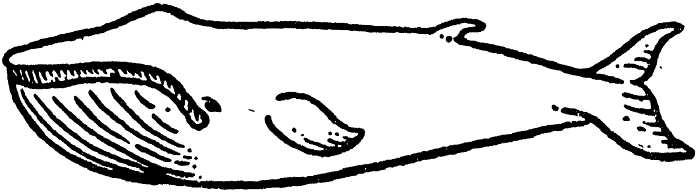
HUMPBACK WHALE 40 TO 50 FT.



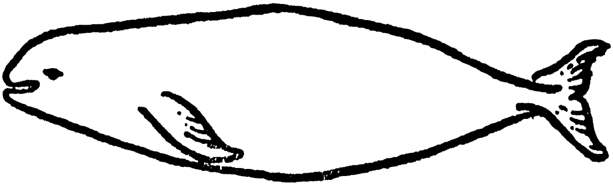
FIN-BACK WHALE 40 TO 50 FT.



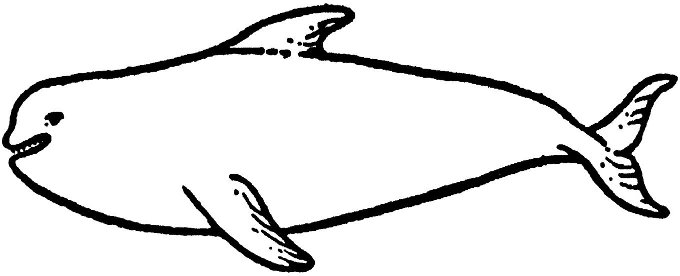
LITTLE PIKED WHALE Length 10 TO 35 FT.



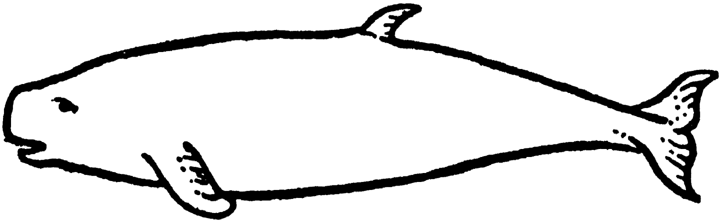
SULPHUR-BOTTOM WHALE 70 TO 90 FT.



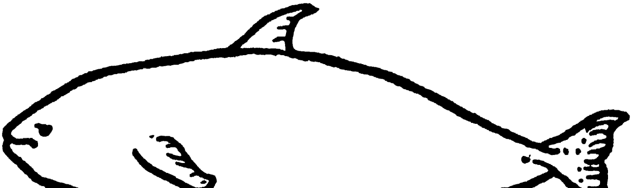
WHITE WHALE 10 TO 12 FT.



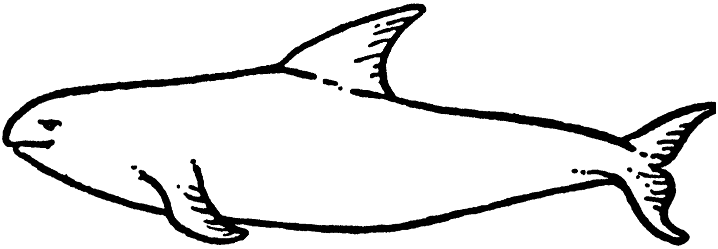
BLACK-FISH LENGTH 10 TO 20 FT.



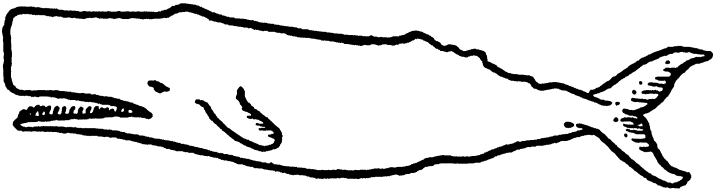
PYGMY SPERM WHALE 10 TO 15 FT.



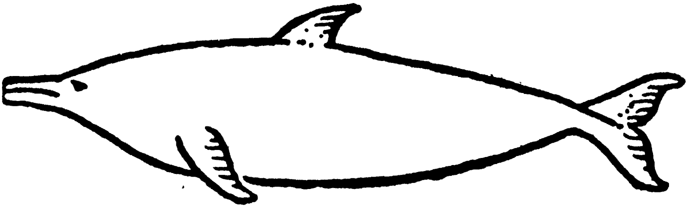
HARBOR PORPOISE 5 FEET



GRAMPUS LENGTH 10 TO 12 FT.



SPERM WHALE 60 TO 80 FT.



COMMON DOLPHIN 7 FEET

almost like round balls with a fin at the top. As they emerge they blow out and take in breath, making a peculiar and unmistakable sound.

The black-fish, also members of this family, are sometimes called the Social Whales. They frequently travel in schools, numbering sometimes two or three hundred. A school containing about forty-five of these whales was sighted by boats off Monmouth in Massachusetts in 1907. They were surrounded by boats and driven into shallow water, where a number were killed. I made a cast for a museum of one that was caught in this way. It measured about fourteen feet in length and was an average-sized specimen. The drawings on pages 132 to 135 will make it fairly easy to identify the different species of whale. The differences in the shape of the heads, the length and position of the dorsal fins, hump, and protrusion on the backs are quite distinctive.

Strangest of all creatures of this type are the narwhals, found only in the Arctic regions. Full-grown specimens measure about six feet. Their most peculiar feature, however, is the fact that they have only two teeth that are in any way developed. In the male the left tooth grows directly forward, forming a beautiful twisted spiral sword of solid ivory—a very formidable weapon. As they have no other teeth, narwhals eat soft food such as squids and jellyfish. A narwhal was the first creature to be seen by Nansen and Johansen on their return southward after their dash toward the North Pole.

Another separate order of mammals that lives in the sea is the *Sirena*, which has only two living examples. The best known is the manatee or sea-cow, of the Florida coast, so named because of its peculiar manner of feeding. Manatees graze on the bottom of the ocean in shallow places along the shore. Their diet consists of plants, grasses, and other vegetation. In the restricted district of their habitat they are found in abundance. They breathe air, give birth to living young, and suckle them the same as other mammals. They cannot live long on land or in water shallow enough to force them to lie on their stomachs, as the shortness of their ribs permits the lower body to press on the lungs and smother them. In captivity, when their tanks require draining and cleaning, they must be rolled over on their backs, where they can lie for some time without injury.

The flippers of the manatees are much more flexible and pliable at the joints than those of either whales or seals, and can be used more freely.

Their eyes are small, and their extremely thick, heavy upper lips are split in the middle and rolled inward. The lips, covered with short, sharp spines, are used to pull food into the mouth in much the same way that a man would try to pull something into his hands by working the fingers if the hands were placed palms together with wrists tied. They open outward from the centre, grasp a bunch of vegetation, then fold up again, while the food is held by the spines until it is worked or pushed into the mouth.

Some specimens of the manatee attain great size. One exhibited in 1912 in New Orleans was said to weigh one thousand three hundred and ten pounds and to eat from sixty to one hundred pounds of grass daily. In the past the animals were plentiful in Florida at the mouth of the Indian River, but because of their tameness so many were slain by unrestrained sportsmen and natives that the herd was almost exterminated. Finally, legislation was enacted to protect them, with promising results. This is as it should be, for so tame, trusting, and harmless a creature, which injures nothing, should be left to roam the Southern waters at will.

It is regrettable that these interesting animals cannot be seen more frequently in zoological collections. Their rarity is, of course, due to the difficulty of transporting them and the food they require. I learned these difficulties at first hand when I was sent to Florida to bring one from the aquarium at Miami to the Philadelphia Zoo. My first step was to construct a wooden tank large enough to give the animal ample room at the ends and sides, and deep enough, when filled with water, to float it. At Miami the tank was filled and the animal hoisted into it from his own aquarium by means of a strong canvas sling. Even in the short time required to accomplish this, the manatee was quite out of breath, but soon recovered. The tank was then lifted to a truck and transportation began—and with it my troubles !

The first mishap occurred when, in taking the animal from the truck, one end was lowered too quickly, and the weight sliding to that end caused an overflow, with the loss of considerable water. Knowing that to permit the manatee's weight to rest on its stomach meant certain death, we lost no time in refilling the tank. Our train was a "way train". At the first stop the brakes were jammed on. The lurch caused more water to spill, and again the manatee rested on the bottom. I wired the next station for water, and in the meantime turned the animal on its side. Upon arrival I found six or seven coloured men awaiting me with five barrels of water. Each man had a bucket, and in a very short time we had the manatee floating again. This happened no less than six times before Washington was reached. Although I spent the night with the animal, doing everything within my power to keep it afloat and comfortable, it was obliged to lie partially on the bottom of the tank more frequently than was good for it. At Washington I refilled the tank and purchased some fresh cabbage. For almost an hour I sat on the edge of the tank feeding my charge by hand, as it was unable to move about enough to feed itself. As it seemed hungry and ate well, my hopes rose.

When the train reached Philadelphia at two o'clock in the morning, several keepers met it with a truck from the zoo, ordered by wire. We put our specimen aboard and in a short time had it in the deep tank which was to be its permanent home. The next morning it seemed no worse for the experience. This was a Sunday, and for that whole day it was a splendid exhibit, viewed by thousands who had never before seen a manatee. On Monday morning I learned that my distinguished guest had died, probably from the effects of his long, hard trip.

I believe the only way to transport and keep these animals in captivity is first to build a transportation tank large enough to float them, with boards to prevent the water from spilling. It is quite necessary to procure from Florida the peculiar type of grass that is their natural food. This can easily be obtained and shipped daily in ordinary cans. The price of a specimen, if a permit can be arranged for, is about five hundred dollars. Its food costs about fifteen dollars a week if shipped in large cans daily, or at least every other day.

The only other living species of this order is the dugong of Australia, which is quite similar to the manatee. Tradition says that these beasts, when seen by superstitious early sailors, were confused by them with mermaids, whence we have the name *Sirenà*.

CHAPTER XI

THE BIRDS

If thou art worn and hard beset
With sorrow that thou would'st forget,
If thou would'st read a lesson that will keep
Thy heart from fainting, and thy soul from sleep,
Go to the woods and hills ; no tears
Dim the sweet look that nature wears.

Longfellow.

To the true lover of nature no form of wild life can offer a more fascinating or universally available subject of study than the birds. One finds them everywhere—in the woods, over the plains, at the seashore, in the mountains. They represent an infinite variety. Some charm by their lovely colouring, some by their graceful flight and movement, others by their liquid song. Nearly all are friends and helpers of the human race.

The man or woman who has learned to know and love these feathered cousins is assured a true and lasting friendship. As we advance in years human friends pass away, but always there remain succeeding generations of bird life—unfailing and dependable in their ability to charm and to divert our minds from the perplexities of modern life.

Clearly I recall my earliest visit to the deep woods of northern Maine and the old deer trail where I became acquainted with the Hudsonian chickadees and their friendly calls. Many years later I revisited the spot. During that time some of my human friends had died, and others whom I had known in that part of the country had moved elsewhere. The camp and surrounding woods seemed lonely and deserted. As I plunged deeper into the forest, however, I was again greeted by the merry notes of the chickadees. I stopped to watch and listen. Finally, one became so friendly that he settled on a branch not three feet away from me and chattered gaily. Again the woods assumed their old charm, and my temporary depression fell from me as from a lonely and homesick traveller who had met a dear friend in a foreign land.

The highest order of birds is the *Passeres,* composed of those characterized by the habit of perching. This order includes all the true song-birds, among whom probably the most interesting are the thrushes. In this country the American robins are perhaps the most popular members of that great family. Always seeking the companionship of man, the robins sometimes build their nests on the porches or under the eaves of occupied houses, and often in nearby trees. Their cheery notes are the first to be heard in the morning and the last at night. I knew of a robin who became so tame and so attached to a friend of mine that it always remained on his estate. A pet crow was also a permanent resident there, and took great delight in pursuing the robin playfully. One day, while the two were playing in the air over a pond, the crow flew a bit too close and collided with the robin, knocking it into the water. It alighted on the edge, watching with apparent perturbation the robin struggling about in the unfamiliar element. Suddenly it flew to the struggling bird and, taking it by one wing, carried it to the shore. The robin, uninjured, was soon playing about again.

The wood-thrush, a close relative of the robin, has a beautiful song, heard at morning and at twilight. As the sun sinks over the hills, leaving the valleys cool and moist, many of the bird-songs will cease, but from the depths of the thickets or deep woods invariably come the clear bell-like and musical tones of this impressive songster. Its music, marking the close of day, might be compared with the

Angelus, and true bird-lovers are almost inspired to remove their hats and stand in silence with bowed heads as the clear, sweet notes rise and fall in perfect rhythm.

Another feathered native, famous as a harbinger of spring, is the bluebird. On one notable occasion, in Boston, I heard its song as early as March 6th. The song is a soft warble not unlike that of the bobolink or European skylark. One of my most interesting recollections concerns a bluebird which I discovered imprisoned in a deserted camp building in the North Woods one day in early spring. How it got into the shack I am not certain—probably through a chimney. It was flitting frantically about the small room as I arrived. I caught it and released it in the sunlight out of doors. As soon as the bird had left my hand it burst into a most beautiful warble which continued as it winged away. It was a happy pæan of freedom—the first time I had ever heard one of these birds sing while in flight. Unfortunately, bluebirds are poor fighters and mild in disposition. The English sparrows take advantage of their pacifism, driving them farther and farther back into the country and depriving us of enjoying their songs and beauty.

One of the rarest treats for the bird-lover is the study of the humming-birds. These tiny representatives of bird life, with their brilliant iridescent colours, flash by at lightning speed, stopping now and then to sip the honey from a flower, or pausing before a blossom, then darting quickly away. The ruby-throat is the most common humming-bird in this part of the world. It may often be seen near old flower gardens. Its nest is a tiny work of art. Lined with soft down from the ferns, it is beautifully made and hidden. On one occasion I spent more than thirty minutes in locating a nest built on a honeysuckle bush on Martha's Vineyard Island, although I knew it was never more than ten feet away as the bird kept darting by my head. About the size of a small wrist-watch, and softly lined, it contained two eggs pure white in colour and not much larger than peas.

In the heart of the Rockies I first met the rufous humming-bird. To see it darting fearlessly about among the great mountains, defying terrific storms and gales, and keeping away from countless enemies, was a most interesting experience. All humming-birds are rather difficult to keep in captivity, and are therefore seldom seen in zoological gardens. They are extremely delicate, nervous, and sensitive, demanding careful handling. Small glass cages with wire tops for ventilation hold them best. Their food in captivity consists of such fresh-cut flowers as are known to contain the most honey.

There are so many species of birds native to America that it would be impossible here to discuss them. Nature has not only scattered them over wide areas of country, but has provided them with marvellous facilities denied her more sluggish earth-bound children. Some birds are equipped to swim, others to wade, and still others to dive, scratch, climb, and run, in addition to their ability to fly. Actually it requires comparatively little effort on the part of birds to remain aloft. Their bodies are equipped with sacs containing air, received through passages leading from the lungs. Many of their bones also are hollow and connected with the air sacs. An interesting confirmation of the use of these air spaces was observed many years ago when the inlet in the throat of a pigeon was obstructed and at the same time a wing was broken so that the hollow tube was exposed. Through the open bone of this wing, the bird, it was observed, continued to breathe. The real purpose of the air sacs and hollow bones is to make the birds lighter and more buoyant. When flying or diving to great depths, they are able, by the use of the strong muscles of their chests, to change the position of air in the sacs and meet the effect of the great strains to which they are subjected. In proportion to size, their hearts are nearly two and one half times larger than the hearts of men or other mammals, to meet the strain on the circulatory system caused by flight. Their hearts are less subject to disease than those of most of the mammals.

More interesting even than their structure is the amazing ability of birds to complete their long periodical migration. Hundreds of thousands of them, from the largest eagles to the tiniest humming-birds, pass in almost endless streams during the migration periods toward the South in the autumn and back North again in the spring. Their flights take place mostly at night. Authoritative observers have estimated that at least nine thousand birds per hour passed certain places which they watched. The speed of these travellers is often remarkable. Foresters record ninety miles an hour for ducks. An albatross is said to have covered three thousand one hundred and fifty miles in twelve days.

Many birds migrate to far-distant points. The American golden plover, for example, breeds in Arctic America, a thousand miles north of the Arctic Circle, and migrates the length of the Western

Hemisphere to winter in Patagonia. The familiar sanderlings of our seacoast migrate to southern Chile and Patagonia, approximately eight thousand miles. Since their flights are usually at night, the birds cannot depend entirely upon their sight for direction. Many times while in a boat off the rocky coast of New England during heavy fog I have seen ducks, loons, and other birds fly by boldly and fearlessly at full speed while we groped ahead slowly and with frequent reference to compass and charts. A satisfactory explanation of this ability is beyond me, although I have heard many different theories advanced.

These are but a few of the many familiar varieties of our native birds which contribute so generously to the charms of nature. Their protection and preservation is of tremendous importance. Sad indeed would be the plight of the farmer if these natural enemies of the insect pests should disappear, and cheerless our woods and fields without their songs and their beauty.

CHAPTER XII

BIRDS OF THE SUN

In each of the larger zoological collections of this country is included a greater variety of birds from many lands than any one student could hope to observe in a lifetime of travel and study. Some are notable for their songs, some for the beauty of their plumage, some for their interesting habits and structural characteristics.

Unquestionably the most gorgeously plumed of our feathered guests are the brilliantly hued birds of paradise. In recent years they have become scarce and difficult to obtain because of rigid restrictions on their exportation. Frequently, however, they are smuggled out of their native land. A common method consists of digging out the centre of a loaf of bread and placing a very young bird inside. It breathes through a few air holes punched into the plug which imprisons it.

This scarcity has sky-rocketed the value of specimens until to-day prices range between two hundred and three hundred dollars for one bird. In captivity they receive the most careful attention. If this is assured they usually live for many years, a source of delight to all visitors.

As this is written it is my good fortune to have under my care in the Philadelphia Zoo a collection of twelve birds of paradise, all in excellent condition and all beautifully plumaged. Among them are the greater and lesser birds of paradise, with the long, flowing tails of cream and gold once so popular for women's millinery, and many other exquisitely coloured varieties.

Even a casual glance at any of these birds would explain why the ancients named them God's birds and birds of the sun. One of the most interesting of the family is the Prince Rudolph's blue bird of paradise. Its brilliant colouration is beyond description. When displaying its charms the bird hangs upside down and opens its wings, allowing the long plumes to spread out and scintillate in short waves of brilliant colour, uttering in the meantime sharp notes of self-admiration and turning its head from side to side as if for a better view. Pleased with the spectacle, it then waves the plumes faster and faster until they shimmer with all the colours of the rainbow; a glistening of purplish-crimson patch scintillates in the sunshine until the bird seems to be enveloped in a riot of vivid hues. Only the males boast such plumes and the Narcissus-like appreciation which accompanies them. During such an exhibition the female in the next cage watches with awestruck admiration. Sometimes she, too, is tempted to respond with a little display of her own. This consists of turning several complete back somersaults—an interesting but less artistic performance.

A smaller but startlingly beautiful member of this delightful family is the magnificent bird of paradise. When on its perch, facing one, it seems by no means remarkable. But when seized by the urge to display, its green breast swells and puffs out to nearly twice its size, its light emerald-green bill points straight upward, and from its back arises a beautiful creamy buff-coloured fan encircling the entire head. It maintains this pose for long periods, evidently determined to win its full share of admiration. Meanwhile the delicate colours of its fan shimmer and scintillate in the sunlight, the plumes rising and falling in perfect rhythm.

The rare Wallace's bird of paradise charms with two long sharply pointed tufts of shimmering green feathers that grow from the sides of the neck. It displays also several long, loose white feathers extending from the top of the wing, which have the odd appearance of being misplaced. When the bird is exhibiting, the white plumes appear to move about in different directions, while the green tufts on the neck are extended straight out on both sides, producing a strange and dazzling effect. Each species, apparently, has its distinctive colouration and method of display. The birds are native to New Guinea and the Aru Islands.

Similarly ingenious is the method of display adopted by the umbrella birds. These exotic visitors are provided with strange crests of slender feathers which, when erected, hang in long, elegant, drooping plumes resembling vaguely open umbrellas—whence the name.

Another most interesting family is represented by the bell birds of South America, so named because of their clear, penetrating, bell-like voices. Of these, the naked-throated bell bird is the most common, and the one generally seen in zoological collections. All have sharp, explosive notes, simulating the striking of an anvil with a hammer and audible for miles. When fully matured, the males are pure white, with bronze-hued patches on their throats. The younger birds are dark brown with white stripes.

As the first rays of sunlight brighten the bird house the bell birds begin their songs, which are repeated at various times during the day. If two are placed where they can see each other their calls are infrequent, but when separated they call and answer, sometimes so often that their notes eventually become annoying. One member of this family has a long, erect carbuncle or horn at the base of the upper mandible nearly three inches in height. Its purpose appears to be purely ornamental.

Another of nature's attempts to utilize the bill for ornamental purposes is seen in the toucan of South America, whose bill is deep and almost as long as the remainder of the brilliantly plumaged bird. At times this large bill appears to overbalance its owner, but in reality it is quite light in weight.

The hornbills of the Old World are also generously equipped. Many of these birds are notable for their curious and distinctive breeding habits. After selecting a cavity of suitable size in a hollow tree, the female enters. Then, from inside, she assists the male in closing the hole with clay and other material, until it is entirely sealed with the exception of a small opening through which her mate may project his bill. In this prison she lays her eggs, hatches her young, and rears them until they are nearly full-fledged—a period of from six to eight weeks. During all that time both she and her family are fed by the male, who passes food in through the small opening.

In the wild the hornbill's food consists of fruits, insects, snakes, small lizards and mammals, eggs, and flowers. In captivity they live well on small balls of prepared food and boiled rice, also varied with mutton and bananas. The balls, about three-quarters of an inch in diameter, are tossed to the birds on their perches and are always caught between the ends of the bill and then tossed by them into the air and allowed to fall into their throats.

Many of the herons and storks also have large bills, as well as unusually long legs and necks. The shoebill stork is a particularly interesting specimen, with its enormous bill shaped somewhat like an old wooden shoe from Holland, and larger than the head of the bird itself. These birds are very rare in captivity and most difficult and expensive to obtain. A pair imported for the Philadelphia

Zoo in 1928 cost no less than three thousand dollars.

The saddle-billed stork is another rare bird. As this is written only two are on exhibition in America, both in the Philadelphia Zoo. They are beautiful exhibits and cost one thousand two hundred dollars for the pair. Their long black bills are marked with red and surmounted by a yellow, leathery substance shaped like a riding-saddle. Below this saddle on the male hang, on each side, small yellowish wattles resembling stirrups.

Nearly all members of the stork family are fish eaters. Some of the smaller varieties will accept only very small or chopped fish, while individuals of the larger varieties, such as the marabou and shoebill, devour three medium-sized fish daily. The pelican, another bird with unusual-shaped bill, eats at least five large fish daily. This bird, as everyone knows, is equipped with a large pouch beneath the bill, in which it stores the fish to be swallowed later at will. Of the several varieties the most common is the brown pelican.

The parrots and macaws, including some five hundred species, are among the most brilliantly hued of our birds from foreign lands. The parrots' greatest distinction is, of course, their ability to talk.

With few exceptions, they are the only birds with the broad fleshy tongues that permit such articulation. One of the most remarkable members of this order is the kea or sheep-killing parrot of New Zealand. Travelling in large flocks, these birds single out a sheep in a herd and alight on its back, tearing fiercely at the wool and flesh until the fat around the kidneys is exposed. This they devour greedily. When the victim dies, the parrots eat the choicest morsels, then turn their attention to another sheep. So numerous have been their depredations that sheep runs have been abandoned, and in many cases bounties set on the kea's head. In captivity, oddly enough, these parrots are quiet, social, and playful, persistently refusing meat as a diet, and subsisting on sunflower seeds, apples, and an occasional carrot and a little lettuce. They remain out of doors the entire year.

The great black cockatoo is also equipped with a powerful bill, which it uses in tearing away the leaves of the palm tree to obtain the central tender shoots, or in cracking nuts. In captivity we have learned it thrives on a diet of common canary seed.

There are numerous varieties of macaws, all large, fine, and beautifully coloured. As a rule, however, they are so noisy that few are kept as pets. Perhaps the loveliest of these birds is the hyacinthine macaw from central Brazil. Its entire plumage is of an almost uniform deep cobalt blue, except around the eyes and at the base of the lower mandible, where the bare skin is bright yellow. The enormous bill is black and very powerful, capable of crushing some of the palm fruits which a man can open only with a sharp blow from a heavy hammer. In captivity the hyacinthine macaw subsists on sunflower seed, canary seed, and hemp seed, with the addition of a few bananas, apples, sugar corn, and peppers in season.

Cockatoos are large, parrot-like birds, distinguished from the ordinary variety of parrots by an extremely long frontal crest. One of the most attractive of them is the great black cockatoo of northern Australia and the Papuan Islands. It may be recognized by the large patches of brightly coloured skin on each cheek, and its large, powerful bill with a long and almost needle-like point.

Of the pigeon and dove family there are many interesting varieties. The great crowned pigeons of the Papuan and Solomon Islands are bluish grey in colour and range in length from twenty-five to thirty-four inches. All have erect, fan-shaped crests on their heads, varying greatly in size and shape. The beautiful plume called "goura", once so extensively used in millinery, came from the crests of these birds.

The mourning dove is the species best known in North America. It resembles the now extinct wild pigeons that once lived in countless numbers in the United States. These are beautiful and harmless birds, but when they rise in flocks from the farmers' fields they offer tempting targets to gunners. They should, therefore, be carefully protected lest they too disappear.

The maternal instinct is a strongly developed trait in both birds and mammals, but there are two groups of birds in which it is often absent—the cuckoos and the cow-birds. These birds do not build nests of their own, but use the nests of others in which to lay their eggs. Usually they select the nest of a smaller bird, so that their own eggs, being larger, receive most of the heat, and in consequence hatch out before the eggs of the rightful owner. The young of the cow-birds grow so quickly after hatching that they soon become larger and stronger than their nest mates, robbing them not only of room but of food, and thriving while the others die of starvation. In some cases, however, the parent birds thus imposed upon assert their rights by pushing the cow-bird eggs out of their nests or flying elsewhere to build new homes. If the cow-bird persists in laying in the new nest, a second storey will be built over it. Nests have been found with third or even fourth floors in which the builder has raised her own brood without interference.

Among the more common birds in zoological collections are the seagulls, of which there are many different species. The most familiar in our own country are the herring gulls and black-backed gulls. Both may be kept out of doors throughout the year if provided with ponds or streams of running water. They breed readily. Many are hatched each year in the Philadelphia Zoo. In the wild these graceful birds are seen along our coast and around wharves, soaring overhead in all kinds of weather. Fishing boats coming in from a catch are usually followed by large flocks of gulls, which skim close to the water to pick up the entrails and other portions of fish discarded in the process of cleaning. Black-backs may readily be identified by the beautiful jet-black mantles covering their entire backs. In the herring gull, this mantle is silver-grey. During the summer these birds go

North to breed, often on the fresh-water inland lakes. I have found many of their nests on the small islands in Moosehead Lake, Maine. They live principally on fish, dead or alive, and have been called "scavengers of the sea". If undisturbed, they are most friendly.

CHAPTER XIII

THE EAGLE AND OTHERS

AMONG the most interesting groups of birds are the eagles, hawks, owls, and vultures. Of these probably the bald eagle, chosen as our national emblem, and one of the noblest of the species, is nearest to the hearts of the Americans. Bald eagles are graceful birds, living generally near large bodies of water, where they build nests from five to six feet in diameter in trees. They live principally on game, which they capture on the wing. Fish also appeal to them, but as they seem unable to dive they resort to piracy. The method is to attack a fish hawk which has made a catch, darting down to strike at it until it drops the fish. The eagle then plunges downward at breakneck speed, usually catching the fish before it reaches the water. The young of this species are almost entirely brown, and do not acquire the beautiful white heads and tails until they are about five years old. In colour the young resemble the youthful golden eagles, but can be distinguished by their scaled legs. The legs of the golden eagle are covered to the toes with fine light-brown feathers.

The harpy eagle, one of the largest and fiercest birds of prey, derives its name from a mythological winged monster sent by the gods against humans who had offended them. Any zoological collection is greatly augmented by the addition of one or more of these beautiful birds. A specimen acquired by the Philadelphia Zoo was captured in South America in a most unusual way. The bird, intent on catching a cat that it saw within a house, plunged recklessly through a window, smashing sash and glass. Observers of this attack quickly boarded up the window while the eagle was still inside and, after a struggle, succeeded in crating it. On one occasion this bird attacked one of our keepers while he was cleaning its cage. It swooped suddenly down from a high perch with outstretched talons, inflicting an ugly wound before the keeper beat it off with a broom as he backed out of the enclosure.

Most eagles and vultures are fed on horseflesh, with the addition at times of a few dead sparrows and, in some cases, fish.

The great bearded vulture or lammergeyer, a magnificent bird from central Europe and the Mediterranean countries, is considered a sort of transition from the eagles to the vultures. It attains a length of forty inches or more, and a wing-spread of from nine to ten feet. In the wild these birds live partially on carrion, and not infrequently upon the young of various animals. In captivity, however, they thrive on a diet of horse rib and intestines.

The American ospreys, or fish hawks, as they are more generally known, are fairly well distributed throughout North America and breed mainly on our coasts or lakes in tall trees, on sand dunes and beaches. They live almost entirely on the fish they catch. Winging its way silently over a body of water, an osprey will suddenly fold its wings and drop like a bullet into the water, sometimes submerging, but invariably rising with a fish in its sharp talons. Then, flying heavily into the air for a short distance, it shakes itself free from water and proceeds homeward, carrying the fish head first. While the female is nesting, the male does the fishing for the family. After the catch has been delivered at the nest, the mother bird tears it apart with her powerful beak, feeding the small pieces to her young, then eating what is left. Sometimes the male tears off a head and indulges in a feast before bringing the fish to the nest, but more often he takes it home intact.

Despite their predatory natures, hawks, eagles, falcons, vultures, and condors live together like a happy family in our big flying cage, seldom attacking one another.

Of the owls there are many varieties. Probably the most interesting are the great horned owls and beautiful snowy owls of our own country. They live well in zoos if provided with dark shelters where they can retire during the day. The snowy owls from the Far North visit the shores of New England and points even farther south in about seven-year cycles, although a few may be seen during other years.

In almost every zoo and in many ponds of private estates may be seen flocks of water-fowl, many of them extraordinarily beautiful. One of the handsomest is the wood duck, sometimes called the summer duck, a wonderfully coloured species, particularly the males. In the late autumn, however, the male goes into what is known as a transition plumage, which is quite similar to that of the female —grey and white with a spot of blue on each wing. Next in line, as an ornamental water-fowl, in my opinion, is the Chinese mandarin duck. Both species are hardy and may be kept on lakes or ponds throughout the year so long as the lake is kept partially open in winter.

The wood duck also adapts itself readily to domestication. It nests in holes in trees, sometimes at a considerable distance from the water. The food of these birds consists of insects, leaves and seeds of aquatic plants, and small nuts and acorns. In some localities they are known as acorn ducks.

On the lake at the Philadelphia Zoo more than one hundred and fifty ducks, geese, and swans of different varieties live congenially. A number of species breed and rear their young on the island in the lake. Their daily menu consists of eighteen quarts of mixed grain (cracked corn, crushed oats, and wheat screenings), lettuce, five pounds of chopped fish, and about a pound of finely ground meat. To keep the lake clean and free from algæ, about ten pounds of copper sulphate or bluestone is placed in a gunny-sack and dragged by boat until it is entirely dissolved. This method is employed about four times a year.

The penguins, from the Antarctic Ocean, constitute a most interesting group of birds. Unfortunately for zoological gardens, penguins are not only difficult to transport but do not thrive in captivity. Our best success was obtained with the black-footed penguins, a few of which we have kept for several years. The largest and finest of the family is the great emperor penguin of the Far South. Rear-Admiral Richard E. Byrd attempted to bring several of these back from his Antarctic Expedition for the Philadelphia Zoo; all died en route. In the spring of 1929 we were fortunate enough to receive a group of eight rock hopper and four large king penguins (next in size to the emperor) as a present from one of the members of our society. All were in excellent condition on their arrival after their long journey from the South. When released from their cramped quarters on to the beach of a beautiful pond especially constructed for them, they plunged into the water and gave an exhibition of swimming and diving surpassing anything of the kind I had ever seen. Darting swiftly around the lake, they would suddenly shoot upward with such velocity as to carry them clear out of the water. Then with a graceful downward dive they would describe a curve under water and repeat the entire operation. Finally they marched out on the beach like a squad of soldiers in training. However, healthy as they appeared to be on their arrival, they lived only through the summer months, despite special and painstaking care. They were fed once daily, each bird receiving its fish from the keeper's hand and swallowing them whole. Soon they became quite tame, following the keeper around the beach and hopping upon his knee, or even into a bucket of fish when circumstances permitted. They were, in fact, our best-behaved and most affectionate bird guests, and their loss saddened us all.

No one seems to know exactly why penguins do not live longer in captivity. Some students blame the heat of our summer weather, some the lack of salt in their water. My own opinion is that death is largely due to the dirt and dust taken into their lungs in this climate, after their accustomed freedom from such ingredients in the desolate Antarctic wastes. I doubt whether this could be remedied. We hope, however, that the Philadelphia Zoo will obtain another flock soon and that its members will live longer.

The largest of all existing birds, and one of the most popular of zoological garden exhibits, is the ostrich, whose principal habitat is Africa. A full-grown male may stand about eight feet in height and weigh three hundred pounds or more. Ostriches are the only birds with only two toes on each foot. Their heads are small in comparison with the rest of their bodies, their legs long and very strong. Wings and tail are short and in the male birds are resplendent with beautiful drooping white plumes. These plumes are of great commercial value, a bird in good condition producing plumes to the value of from thirty-five to fifty dollars per year. No hardship or pain is inflicted in the process of plucking, as the feathers are cut off and the roots left to dry up, when they can easily be plucked out. Although unable to fly, ostriches are swift runners. A single stride when the bird is well under way is said to approximate twenty feet. Almost anything within their reach is edible to ostriches. If oranges are given them six at a time, they will be swallowed so quickly that all can be seen as they move down the neck.

Another bird of the same character is the rhea, sometimes called the South American ostrich. The rheas are confined to the pampas, are much smaller in size, and lack the valuable plumes of the ostriches. They have three toes. When undisturbed they become quite tame, but when hunted are wary and can outrun the swiftest horse.

In captivity ostriches are fed chopped alfalfa, cracked corn, and bran dampened with water. Three times a week each bird receives a pint of chopped carrots, beets, and apples mixed in equal parts.

Second only to the ostrich in size among living birds is the emu, a normal specimen measuring five feet or more in height. The emu has been called the King of Australian birds, and is confined to that continent. In colour it is greyish brown, with a darker dividing line straight down the back. From this line the plumage parts and falls gracefully down each side. The feathers are so small and fine that at a distance they resemble hair.

The cassowaries of the Papuan Islands, New Guinea and others, differ from both the ostriches and emus. Lord Rothschild, in his monograph on the genus, recognizes eight or ten different species. All are beautiful birds with long legs, some standing as high as five feet. Their plumage is glossy black or deep brown. Many carry curiously shaped casques on their heads, and some are marked by long, loose wattles hanging from their throats. The casque, bare head, and wattles are all beautifully coloured in red, orange, or blue in the different species. Instead of wings they have five or six long barbed quills projecting from the points where wings would join the body.

Cassowaries inhabit the forest rather than the plains—here, too, differing from the ostrich, rhea, and emu. They are dangerous birds to handle as their inner toes are provided with knife-like claws which can rip open man or beast.

CHAPTER XIV

THE REPTILE HOUSE

The reptile house has always represented to me one of the most fascinating features of any zoological collection. The gorgeous colouring and sinuous movements of its inmates reveal a beauty which is too seldom appreciated at its true value. Superstition and prejudice, built up through the ages around the snake, apparently conspire to rob many visitors of the opportunity to study safely and at close hand one of the most interesting of all zoological exhibits. Yet many persons who literally have to be coaxed into the reptile house forget their inborn and inexplicable dread immediately after a first glance at these remarkable exhibits.

Contrary to the popular impression, snakes are not necessarily slimy and repellent, but clean and dry. The majority of them are non-poisonous, harmless, and safe to handle. A bite from a non-poisonous snake is no more harmful than the bite of a cat, mouse, or even of certain insects, and if properly washed out and touched with iodine can be dismissed from the mind. In the case of poisonous snakes, however, a bite can quickly prove fatal. Needless to say, visitors are carefully protected from their fangs in all zoological exhibits.

The largest of snakes are the constrictors—pythons, boas, and anacondas—all perfectly harmless so far as poison is concerned. Many of them, I believe, actually enjoy being handled. One fine nine-foot specimen of the Madagascar tree boa was for many years a pet of our reptile keeper, who could take it from the cage at any time with perfect safety. It was never known to attempt to bite or strike. Our twenty-three-foot reticulated python has never even threatened an attack, although at times, when excited, it has struck at the glass of its enclosure. Usually these big snakes are quiet. They are fed about once a month, some of them easily swallowing pigs weighing thirty or forty pounds. In the process of swallowing, such a snake's jaws unlock on the sides. The windpipe is so arranged that the reptile can continue to breathe easily while swallowing, a process which often requires thirty minutes or more. For several days after feeding, these snakes are enormously distended, and lie dormant. If they miss a few meals, they apparently suffer no inconvenience. One specimen under my care ignored food for twelve months, then began eating again as if nothing unusual had happened. The reticulated pythons are found in Burma and the Malay Peninsula.

The anaconda, a large non-poisonous constrictor from South America, spends its life in and about the water. Despite tales of the great size of these snakes, I have never seen one exceeding twenty feet in length. Like the pythons, they are non-poisonous and have great constricting powers. Their feeding habits are most irregular. At the Philadelphia Zoo we wait until the specimen indicates a desire to eat, then supply the food, which it devours greedily. In some collections, however, these snakes are subjected to periodical forced feeding—in my opinion a method of doubtful value.

All snakes in good condition shed their outside skin about every two months. Before shedding, the reptile assumes a dull greyish colour and appears to be blind. The skin starts to peel at the head. Then it crawls persistently through small openings between rocks or in the crotches of trees until the loose skin of the head is caught, permitting the snake to glide slowly out of it. The old skin is turned inside out in the process. After the skin has been shed, the snake's eyes regain their clearness and the new underskin shows bright and shining.

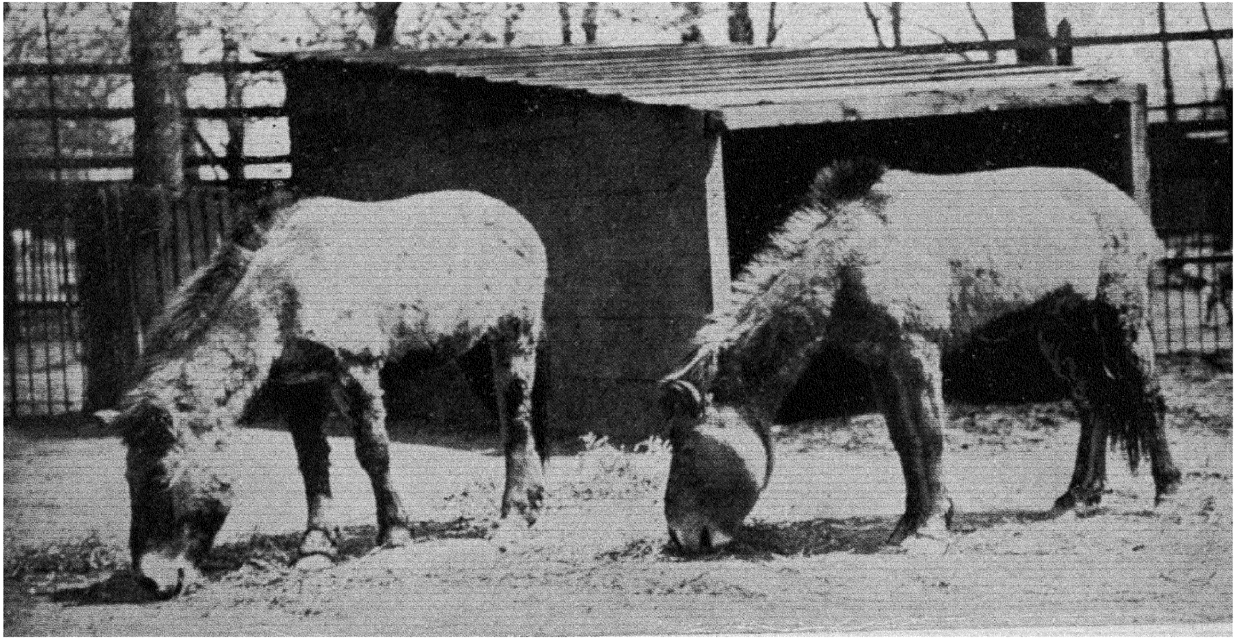
There are several varieties of poisonous snakes in North America, among them the rattlesnakes, the moccasins, the copperheads, and the beautifully coloured coral snake of Florida and the extreme South. Pine snakes, hog-nosed snakes, garter snakes, and many others abounding in our woods and fields are not only harmless but often beneficial to the farmer.

The most deadly of all snakes (and probably of all living animals) is the king cobra, or hamadryas, of Africa, which attains a length of from twelve to fourteen feet. It is also the most intelligent of snakes. Most snakes will strike immediately at food placed outside the glass of their cages. But the cobra understands that this transparent wall is impenetrable. At the sight of food it will go immediately to the door where meals are always offered, and wait there.

The king cobra feeds exclusively on small snakes, usually those of the non-poisonous varieties, swallowing them head first. On one occasion a five-foot indigo snake was thrown into the cage of a large king cobra in our zoo. The cobra was hungry and made several quick lunges, which the indigo, a notable fighter, avoided. Finally, the cobra caught his intended victim by the head. The indigo fought hard, but could not escape. After that the attendants left, assured that the cobra would have his meal. When they entered the reptile house the following morning, however, they were amazed to find the huge king cobra dead, while the victorious indigo moved cheerily about the cage. Investigation showed that when the cobra's poisonous mouth closed on the head of the indigo snake, the latter closed its mouth on the exposed windpipe inside the cobra's mouth, shutting off the supply of air and choking its attacker to death. I know no other instance of this kind.

There are many varieties of the cobra, including the Indian cobra, Egyptian cobra or asp, and the South African cobra or ringhals—all vicious, deadly, and hostile in captivity. Attendants handling such specimens must maintain constant vigilance. Not even experts dare relax in their presence. Many have lost their lives through a moment's carelessness after long association with the reptiles.

One of the greatest authorities on such poisonous snakes is Dr. Afranio do Amaral, of Brazil. To see



PRJEVALSKY'S WILD HORSE

The only true wild horses of to-day, found in the desert regions of Mongolia.

him obtain venom from them for serums is an amazing experience. In extracting the poison he catches the snake with his bare hands and instantly runs his hand up to the safety zone directly behind the head. Then he pushes the mouth open and presses the fangs through a thin piece of rubber, previously stretched over a drinking-glass. A series of kneading motions behind and over the poison pouches on each side of the head containing the venom expels the deadly fluid, which may be seen dripping into the glass. Sometimes quite a large quantity is extracted from one specimen. As soon as the dripping ceases, the snake is dashed through water to wash off the remaining fluid and thrown back with the others. This process is called "milking" the snakes.

The Gaboon viper is another poisonous reptile. It is a very heavy snake with an extremely broad head. The entire body is beautifully coloured black, pink, and grey in odd-shaped, sharply defined futuristic markings. The venom from this reptile is so deadly that unless almost instantaneous action is taken a victim of its bite dies.

Among other poisonous reptiles are the tiger snakes of Australia and the deadly mambas of West Africa. The mambas hang from the trees like long green tendrils, which they resemble in colour. Natives travelling through places they infest usually slash at vines and bushes before and above them for protection. The mamba's fangs are close to the end of the upper jaw, and the least nip from them sends a charge of deadly venom directly into a victim's system.

Travellers planning trips through areas where deadly snakes abound should carry at all times the anti-venom serum made to treat the particular venom of the snakes indigenous to that country. Rattlesnake anti-venom serum, for example, is not effective in the treatment of a cobra bite, and cobra anti-venom serum will not combat the effects of a rattlesnake bite. Each distinctive venom requires its own antidote.

The fangs of poisonous snakes are usually long and delicate, with extremely sharp points. Like hypodermic needles, they are hollow, with small openings at the ends, from which the venom is ejected. The tops of the fangs are connected with poison sacs on either side of the head. When not in use, the fangs are folded back and covered with a protecting membrane. When a snake strikes, the jaw is spread wide open, throwing the fangs forward and out of the sheath. As they enter the victim's flesh, pressure on the poison sacs sends charges of deadly fluid into the deepest point of the wound. Then the fangs are withdrawn, and the snake draws away to await its victim's death before beginning to eat.

As I have said, there are only a few poisonous snakes in the United States, but their bites can be fatal if not treated immediately. The rattlesnake is deadly, but more of a gentleman than the copperhead. It warns before striking. The copperhead gives no warning. Those who are interested may find information concerning anti-venom serums, their use, and where they may be obtained, in the appendix of this volume.

The lizards, like the snakes, include venom carriers in their general family. Of all the lizards, large and small, that abound in North America, however, only two types are poisonous. These are the gila monster (pronounced heela) of Arizona and New Mexico, and the Mexican beaded lizard, which ranges from Central Mexico to northern Central America. Both are of medium size, from twelve to eighteen inches in length, fat and chubby. In colour, the gila monster is a beautiful reddish yellow, with black markings. The beaded lizard is black, though spotted with bright colours.

Unlike snakes, their teeth are not hollow, but are grooved and hooked slightly backward. Once they fasten into an object they hang on with bulldog tenacity, while the lizards grind their jaws backward and forward, injecting poison at every movement. In the wild they rely chiefly on ants for food, but in captivity they thrive on ground meat and eggs.

Largest of all the known lizards in the world is the Ceylon lizard, known among natives as the kabaragoya. One specimen kept in the Philadelphia Zoo for some time measured nine feet and was quite tame. When it first arrived the newspapers made photographs of it which suggested, unintentionally, an animal as large as some prehistoric monsters. Then a reporter who had seen the long red tongue shooting out nicknamed it in his article the fire-spitting dragon. This publicity attracted such crowds that our reptile house was completely filled, with not even standing room for the long line waiting outside. Some visitors were, of course, disappointed, but after they saw the red tongue and learned that this really was the largest lizard in captivity they apparently felt the inspection well worth while.

The small lizards, of which many varieties may be found in all parts of the world, are as a general rule beautiful and harmless. Among the most interesting groups are the chameleons, represented by about forty-five species inhabiting Africa, Madagascar, Spain, and Ceylon. The species known as the common chameleon is entirely arboreal. When on the ground these lizards appear quite awkward, but in the trees they are much more at home, although difficult to locate because they blend so naturally with the colour of the foliage. In moving about, the chameleons grasp the branches with pincer-like feet and steady themselves with long, prehensile tails. Their eyes protrude and move so freely that the lizards can see in almost every direction. Furthermore, the eyes can move independently of each other. While one may be looking straight ahead the other can see upward or sideways. The food of chameleons consists of flies, crickets, grasshoppers, spiders, and other insects. On the hunt, the chameleon moves slowly and cautiously toward its victim, until well within striking distance. Then its long straight tongue shoots out like a flash to a distance sometimes of six or seven inches. The insect adheres to the sticky substance on the tongue and is quickly snapped back into the mouth to be masticated by the sharp teeth before swallowing.

Another curious member of this family is the horned lizard, or horned toad, common in the south-western United States. Although it resembles the toad in shape and actions it is a true lizard.

Members of the family of alligators, crocodiles, turtles, and tortoises are generally found in the reptile houses of zoological collections. All are quite sluggish and easy to care for. The common alligator, so plentiful in Florida, where the young are sold in large numbers to tourists as souvenirs, sometimes lives to a ripe old age and measures from twelve to fifteen feet in length. One difference noticeable to casual observers between alligators and crocodiles is seen in their snouts. The former have broad, round, flat noses, while those of the latter are quite sharply pointed. Alligators inhabit the south-eastern United States, although one small species is found in China. The American crocodiles range through parts of Florida, Mexico, Central and South America. Only one or two species of alligator are known, but many species of crocodiles are found in nearly all tropical and semi-tropical parts of the world.

The crocodiles are much swifter in movement than the alligators. Apart from their fearful bite, they can do great damage with their long, powerful tails. The twelve-foot specimen of American crocodile now in the Philadelphia Zoo feeds principally on fish, while the big alligator seems to be satisfied with from twelve to fifteen pounds of horsemeat a week. A large salt-water crocodile purchased by the zoo a few years ago measured about eighteen feet in length and seemed in excellent health when acquired. It refused all food, however, and finally died. An autopsy revealed twelve feet of stout manilla rope in its stomach, evidently the cause of death.

Tortoises are usually an interesting though unexciting exhibit. Perhaps the most popular of them, among visitors, come from the Aldabra and Galapagos Islands. These huge reptiles weigh sometimes from two to three hundred pounds, measure four feet or more over the curve of their shell, and stand two feet high. Years ago, when sailing-ships passing the islands ran short of food, their crew would put ashore and capture a number of these tortoises, then place them in the ship's hold to kill as needed for fresh meat. The species living on the Aldabra Islands is called *Testudo elephantina*, or elephant tortoise. In captivity the diet of these giants is purely vegetable, consisting of such items as bananas, lettuce, and, in season, water-melons. In summer they stay out of doors, but during the winter they must be kept inside, in a warm and rather humid atmosphere free from draughts, as they "catch cold" easily.

An interesting group (of a different class from the reptiles) is the *Batrachian,* which includes frogs and toads. Its largest member is the giant toad of tropical America and the West Indies, but various species are so common throughout most of the United States as to require little comment here. To the amateur naturalist, however, observation and study of the many varieties of this order is well worth while, since even the smallest of them have surprisingly interesting characteristics.

CHAPTER XV

NEW ANIMALS

NEW specimens are acquired by the large zoological gardens in two ways—by birth and by purchase. Occasionally they are received as gifts, but this method of building up a large collection cannot be depended upon. Naturally the baby animals born in captivity arouse the widest interest among both children and adults, as in the case of the young lions previously described. But this applies to all our youngest guests. I know of no more appealing sight than that of a baby monkey clinging tightly to its mother while she moves carefully about the cage ; or of a great awkward orang-utang caring for her infant so tenderly that her powerful, heavy hands actually tremble with solicitude as she performs such maternal duties as picking pieces of hay from the youngster's face or teaching it to walk and climb. Some animals may kill their young if frightened, but I recall no instance of an anthropoid ape yielding to this impulse.

No preparations need be made before the arrival of new members in the primate house, apart from assuring the mother solitude, providing sufficient hay for her bed, and supplying sufficient food. With the *Carnivora,* however, elaborate precautions and preparations are generally necessary.

In the Philadelphia Zoo the arrival of a baby hippopotamus is always a red-letter day. The hippopotamus house is closed for weeks in advance. Rigid care is taken to keep the temperature between seventy-five and eighty degrees, the water at the proper depth, and all other arrangements suitable for the reception of a seventy- or eighty-pound infant. Within five minutes after its arrival the baby hippo stands and walks in the shallow water. The mother moves her three tons of bulk cautiously about the cage, keeping the baby close to her head lest it get out of her sight and be crushed. Newspapermen and photographers, who have eagerly awaited the arrival, crowd the hippopotamus house to picture and describe its newest resident, and attendance increases by leaps and bounds as visitors flood to greet the youngster. Five baby hippos have been born in the Philadelphia Zoo. They were either sold or exchanged for other animals. Prices for these youngsters range from two thousand five hundred to five thousand dollars apiece.

Although sea lions are seldom born in captivity, the stork has brought three of them to the Philadelphia Zoo in my time. For about a year these babies partake of no food except mother's milk, despite the fact that they grow quite rapidly.

A natural instinct with most wild animal mothers is to hide their young, and nature usually assists them. Among many mammals, birds, and reptiles, the young differ in colour from the adults, a protective device in itself. Young deer, for example, are usually of a light brownish red marked with white spots, an excellent camouflage which enables them to blend into a background of trees, bushes, and foliage-strewn earth. The South American tapir is somewhat similarly protected in its youth, but as it grows older the spots disappear. Baby lions are also spotted.

Among the animals that breed freely in zoological collections are the American bison or buffalo, the llama of South America, the wild horse, the goat-like tahr from the Himalayan Mountains, all species of the deer family, and the Barbary sheep of Africa. The prong-horned antelopes of our Western plains are less prolific in captivity. So far as I know they have been raised in only two zoos. Bears breed well when undisturbed and able to "den up" quietly. If frightened they may destroy their young. Polar bears have been born in the Milwaukee Zoo, but these are the only births in captivity of the species of which I have heard. Ducks, geese, gulls, turtles, and snakes all breed freely under proper conditions. As a general rule, the successful breeding of many animals in captivity depends on whether or not a favourable environment is prepared for them.

When purchased, specimens are usually acquired from firms engaged in collecting animals throughout the world for zoological collections. Their prices vary according to the demand and rarity of the animal desired. Sometimes the specimens are immediately available; sometimes they are held in the firm's European quarters; sometimes they must be sought and captured in their native haunts. A glance at some of the prices may be of interest. Before me is a list offering for immediate delivery a male cheetah for $650; a Malay sun-bear, eighteen months old, for $145; a pair of adult gnus for $1,350; a giant red kangaroo for $400; and monkeys ranging from $50 to $100 apiece. Of the birds I am offered a pair of bearded vultures for $1,000; water fowl ranging from $11 for a pair of pin-tail ducks to $300 for a pair of red-breasted Siberian geese. Parrots range from $5 to $40 a pair, and various other birds from $4 for a European blackbird to $40 for an orange or white-breasted toucan.

Ostriches are among the most expensive of birds. One from Morocco is offered for $500. The list includes also emus for $350 each; grey rheas for $225, and white rheas for $300 apiece, and an orange-necked cassowary for $250.

In the European quarters, awaiting delivery, are tigers ranging in price from $900 for a Sumatra female, to $7,500 for a pair of Siberian specimens about two years old. Pumas are offered for $350 a pair; African leopards at $250 each. A black jaguar about eighteen months old is valued on the list at $1,700; hyenas at $175 each, and smaller carnivora, including foxes, serval cats, and Siberian badgers at from $45 to $220 a pair. A Polar bear has a price-tag of $350; a Tibet bear, $175.

Elephants bring various prices. A pair of full-grown Africans is listed at $12,500, and several single specimens at from $5,000 to $6,500. Indian elephants may be had at approximately $2,250 each. Rhinoceroses and hippopotamuses are also expensive; a pair of the former is listed at $13,000, and of the latter at $8,500. Tapirs bring from $400 to $700 each, and zebras about $1,200 a pair. Various foreign breeds of antelope are offered at prices ranging from $175 to $850 each. A pair of red buffalo may be bought for $2,500; a pair of yaks for $750; a pair of Siberian camels for $1,500. Llamas and alpacas bring about $700 a pair, and Siberian ibex $2,000. Rock python snakes, from seven to twelve feet long, are offered at from $25 to $100 each.

Frequently a representative of one of the firms supplying specimens may call in person to offer special bargains or particularly rare and desirable animals. He will offer, for example, a pair of giraffes for $10,000 and an orang-utang for $3,500. We have representatives of both species, so these are rejected. Very well; he has several boa constrictors and anacondas of various lengths. These he will sell at the flat rate of $7.50 a yard. Or there are death adders for $5.00, and various other bargains.

I compare his list with several others that have come in my morning mail. There is, for example, one from a Middle Western breeding farm. Its prices are higher, but then the freight charges will be less. I note that lions are particularly cheap this season. They are breeding rapidly. A pair of tigers at $2,000 looks tempting, for our zoo now lacks a breeding tigress, and several litters of cubs would soon repay that investment. This must be considered. The possibilities of the breeding and raising of young is a feature that no zoo director dare ever overlook, for in spite of the fact that American gardens are now well stocked, it is becoming harder each year to import specimens. It will not, in fact, be many years before dealers will be unable to collect specimens in foreign countries without special permission or request from some well-known zoo official direct to the governor, rajah, or other dignitary of the country. With this in mind I have made several contacts with officials of foreign countries.

Already I have experienced the benefit of such action. Not long ago a cable of mine to the Sudan Government quickly released a number of valuable specimens that were being held there by an agent who cabled me it was impossible for him to get them out.

But whether the garden is in a position to buy or not, dealers receive every possible consideration. One never knows when some extraordinarily valuable specimen may be obtained to fill out the exhibit of even the most complete zoo, as, for example, the now priceless one-horned Indian rhinoceros or the pair of shoebill storks—the only pair in captivity—that we have acquired during the past few years.

Animals acquired by purchase, gift, or capture can cause exciting moments while being transferred from the crates, or other containers in which they arrive, into their permanent enclosures. As a result, a definite technique has been developed in the Philadelphia Zoo; for example, in shifting different kinds of captives from crates to cages, or from one enclosure to another.

Not long ago a large python arrived in a strongly constructed crate. The problem was how to transfer it into the reptile house enclosure without injury to either the keepers or the valuable specimen. After carefully planning all movements, the head keeper raised the lid of the box cautiously, threw a burlap bag over the reptile's head to blind it, and at the same time gripped it firmly around what might best be described as the neck. Then the animal was pulled out about two feet and another keeper grabbed this part of the body. This method was continued, until about ten men were holding the snake at intervals of about two feet. The greatest care was exercised to keep it from coiling. Then followed the process of getting the snake into its cage. This was accomplished by utilizing a long, heavy board, fitted tightly to the door of the cage, with a hole in the centre a trifle larger than the snake's body. The head was pushed through the hole, while men with burlap bags pressed against both board and door to prevent the snake from forcing either open or from turning back through the hole, and the pushing process continued until the entire length of the reptile was inside. Then followed a long wait to allow the snake to quiet before the board could be safely removed and the door tightly fastened.

The small non-poisonous snakes offer fewer problems. Any one of these can safely be caught and handled if picked up gently by the centre of the body. Poisonous snakes must be handled very carefully, preferably with a noose on the end of a stick. Many persons thoroughly accustomed to poisonous reptiles pick them up with the hands, but under no conditions would I advise this method. A lasso can easily be made with a leather strap and two poles. Lassos should be used only when necessary.

By far the best method of handling small snakes is to trap them. The majority of poisonous snakes can easily be lured into a dark box and caught when a sliding door is closed. Boxes for trapping should be just large enough to give the snake room to go in and curl up, and, in addition to the sliding doors, should have holes for air. The box is put into the cage with the door open and left there until the snake enters of its own accord. This usually requires only a short wait, as most reptiles are fond of dark dens. After the captive has settled down inside, the door of the box is closed with a long stick and tightly fastened with nails or screws. Similar caution must be exercised when releasing the snakes into their new cages. Many snakes which come to the zoo in burlap bags are put into their cages by dumping the bag.

Regardless of what animal is concerned, the process of shifting from one enclosure to another requires the greatest caution to avoid injury to either man or beast. The use of force should be avoided. Trapping and the use of runways built for the purpose are not only more efficacious but more humane. Members of the *Carnivora* family, as a rule, are easily trapped in transportation crates if the work is unhurried. At the Philadelphia Zoo the method is to set a crate of proper size, with open bars in front and a sliding door in the rear, against the cage or enclosure, then fasten it firmly with chains. This safety measure is particularly necessary when such large animals as the lions, tigers, or bears are concerned. It not only prevents the captive from moving the box, but avoids the possibility of escape by chewing, as has occurred when ropes were used. After the box has been firmly fastened, the cage door is opened and the sliding panel of the crate lifted. Thereafter, the animal's food is placed in the crate. For several days it may refuse to enter and partake, but this short fast should cause no injury. Finally, after it is thoroughly accustomed to the crate, the sliding panel is dropped while the animal is feeding inside. Great care must be exercised not to drop the trap too quickly while the animal is under it, for if a captive is struck he will fear and avoid the box for days. When lions, tigers, or other long-tailed beasts are being trapped, small blocks of wood are set under each end of the door to prevent it from dropping on the tails. Animals trapped by this method soon quiet down, but boxes must be strong enough to withstand assaults if they become enraged. The door should be tightly nailed or screwed in place before the crate is removed.

Temporary runways are used in shifting animals from one cage to another. Deer, antelopes, and others too cautious to be lured into a crate are sometimes overpowered by a number of keepers and carried to the shifting crate. The abduction must be performed swiftly and carefully. The keepers grasp the animal only around the neck and body, avoiding the legs, which are easily broken.

New arrivals released into their permanent enclosures are handled just as cautiously. This care is necessary. I have seen elk break their necks or legs from over-excitement when first released from crates. No animal should be released after a long journey until it has rested and had a chance to calm itself. The best method is to release the deer, for example, into a shelter supplied with food and water, and keep it there overnight. Early the next morning the door should be quietly opened by the keeper, who leaves immediately. The animal, seeing no one around, will carefully make its way out into the fenced enclosure and become accustomed to its surroundings. No new animal in the Philadelphia Zoo has injured itself during shifting processes since these methods were adopted.

Small animals, monkeys, and birds are usually caught in nets. The object in every case is to avoid frightening the captive and to subject it to the absolute minimum of necessary handling.

All mammals, birds, and reptiles are better off if never handled at all. In zoological gardens this is not always possible, but they are handled as little as necessary. Many animals are undoubtedly killed by improper handling, even though death may not occur immediately.

Some of the necessary and most difficult jobs of handling occur when the huge *Carnivoras* must be treated for illness or accident. On one occasion we noticed that Sultan, our stately lion, kept licking one of his enormous feet, now and then biting at it. We recognized the trouble. One of his great claws had turned and grown into the pad of the foot, as often happens in captivity, where the animals miss the rocks or hardwood trees on which they sharpen and wear down their claws. A long iron bar, with a rope lasso on the end, was thrust into the cage. Sultan struck at it in rage, loosening the noose. The keeper readjusted it and carefully tried again. Finally the rope fell over that great head. Then four men pulled the lasso tight around the lion's neck and slowly dragged him toward the front of the cage. Roaring, growling, snarling, and biting at the ropes, Sultan fought every inch of the way, but eventually he was brought against the bars. While he was thus held, the injured paw was lassoed, dragged out through the bars, and treated. Even after the ingrown nail had been clipped, the operation was continued until all the sharp claws had been properly trimmed. Not until then were the ropes loosened. Sultan, unchastened, leaped to his feet, rushed to the front of the cage, and tried to avenge the indignity thrust upon him by striking out at the keepers. Within a few days, however, both his foot and his disposition had improved.

That is one of the methods used in handling wild animals in zoological gardens. The work of capturing and crating them in the jungle is far more thrilling and different. Nevertheless, the problem of treating and at times shifting two or three thousand of them at various periods throughout the year can assume all the proportions of a man-sized job.

CHAPTER XVI

HEALTH AND NATURAL INSTINCTS

As with human beings, the health of animals depends on four things—wholesome food, fresh air, sunshine, and sufficient physical exercise. In the zoo the first three of these requisites must be made available by the management. The fourth the animals obtain for themselves.

All animals in their natural state obtain sufficient exercise in the constant search for food. In captivity, instinct warns them to continue their exercise even though food is assured. That is why Bobby, the white-handed gibbon, whom I have already described, swings gracefully from rope to trapeze for hours at a time. After twenty-four years of such play his muscles remain large and powerful, and he has lost little of his agility. The chimpanzee Sultan rocks his cage with his powerful arms and sometimes frightful dance, which uses every muscle in his body and keeps him physically fit. Lions, tigers, and other *Carnivora* pace to and fro, jump at their lounging-boards, scratch at the floor, and stretch repeatedly.

The stretching process is of great importance, as all animals seem to understand. It brings every muscle into play and limbers up the entire body. Watch the ordinary house cat as she awakens from a nap and see how, with forefeet spread forward, she indulges in a prolonged stretch which brings the muscles of the back, neck, and head into action. Then each leg will be extended until a generous stretch of the entire body has been enjoyed. Perhaps then she will reach high up on the wall to scratch and sharpen her nails. This is precisely what lions and tigers do in captivity as part of their daily exercise.

Baby animals, like small children, need a great deal of exercise. That is why young lions roll about and chase one another like kittens.

A wild horse is another believer in physical fitness. He enjoys dashing madly back and forth the length of his enclosure many times daily. Young buffalo also enjoy their frequent races. Birds flit from perch to perch, stretch and flap their wings, sometimes stretching them, then pulling them slowly back. This gives them virtually the same exercise they would obtain in flying.

There are, in fact, few lazy animals in the zoo. Polar bears have the peculiar habit of pacing quickly to the ends of their cages, then raising themselves and turning quickly to pace to the opposite walls. Sometimes they stand in one position, swinging heads and fore parts from side to side in weaving motion. The sea lions swim around their tank at high speed for hours at a time. Like all other animals, they also enjoy basking in the sun. With the animals, I am a firm believer in the value of sunshine and fresh air. These natural life-giving agents, available to all, do more good in many cases than medicine.

During the colder months of the year it is, of course, important to keep many animals from warmer climates indoors, but whenever possible our specimens are kept outside. Monkeys and cat animals with long tails must go indoors early to protect their tails (which have little circulation) from being frost-bitten. When this occurs, the animal will bite at it until sometimes a portion is gnawed off. Some of the deer and antelope from foreign countries give birth to their young during the winter months. In such cases the mother must be placed indoors, or the baby will perish. Most of the bears, with a few exceptions, such as the sun bear, enjoy cold weather. They exercise a great deal during the day, and when tired lie down and make themselves comfortable in the sunshine.

Many of the animals that the zoo visitor sees asleep during the day are nocturnal and take their exercise at night. Nocturnal birds, such as owls, are particularly active after dark. Others hesitate to venture forth in daylight because of an inherited or remembered fear of attack. I have hunted through the deep woods and thickets of northern Maine for an entire day without observing a deer, and then, just at dusk, have seen dozens come boldly out into the open to feed.

Numerous other instinctive habits of wild birds and animals are retained by them in captivity, even by those born and raised in zoological gardens. The wild herons will stand for hours on the edge of ponds watching for frogs, small fish, or other prey, and when anything edible comes near they will strike with unerring aim, impaling it on the ends of their sharp bills. In captivity they continue to stand on the edge of the artificial pond with hopeful expectancy hour after hour, day after day. Nothing ever comes to them, since no live thing is placed in the pond, but the hunting instinct still holds them in its grasp.

The wild butcher-bird impales its prey on sharp thorns or hangs it up in the crotch of a tree as a provision-store in the event of scarcity. In the zoo, although food is assured daily, it persists in hanging pieces of meat between the bars of its cage. Squirrels in the zoo continue to bury nuts or to store them in their boxes as they stored them in hollow trees in the wild.

A striking example of the persistence of such natural instincts was afforded recently by an orangutang which had been brought to the zoo while quite young. At the age of about four years it eluded the keeper and climbed a tree. Immediately, it began breaking down the topmost branches, twisting, bending, and weaving them until it had begun a nest such as uncounted generations of ancestors had built in the forests. Woodchucks or groundhogs, although given fresh food daily, still hibernate in captivity, remaining dormant in their holes for periods of four or five months during the winter, when supplies are scarce in the wild.

I believe that all zoological gardens should be designed in a way to make everything conform as nearly as possible to conditions existing in the natural habitat of the specimens, thus encouraging them to act naturally. Trained animals are, of course, interesting, but wild animals behaving in their natural way are still more fascinating, and, at the same time, educational.

To accomplish this it is important that those in charge of large collections know the animals' natural habitats and traits. With the enormous increase of zoological gardens in America during the past ten or fifteen years, much more attention has been paid to such details, and as a result most of the large modern zoos are able to keep animals longer and to give them more intelligent care than in the past. The old method of placing specimens in small cages and throwing them any kind of food they could be made to eat has been discarded. In consequence, the modern zoo is really a scientific institution devoted to the preservation of many swiftly disappearing forms of wild life.

CHAPTER XVII

FEEDING OUR GUESTS

No feature concerned with the health and comfort of our animal guests in the Philadelphia Zoo receives more attention than their daily menus. In any zoological collection the diets must approach as closely as possible those to which the animals have been accustomed in the wild. Except in the case of carrion eaters, it must be as fresh as any food used for human consumption, and as carefully selected and prepared.

Naturally the cost of feeding our 3,300 specimens is enormous—approximately $4,000 a month. For this we purchase, among other basic necessities, about 175,000 pounds of mixed and timothy hay, 10,000 pounds of meat, 20,000 pounds of corn, bran, and oats, 5,500 pounds of fish, 1,000 pounds of sunflower, canary, and hemp seed, 300 pounds of rice, 2,000 pounds of flour, and 400 pounds of rock and white table salt.

But these items represent only the coarser, more Spartan elements of our varied menus. On the lists of monthly purchases are included such dainties as 75 barrels of lettuce, 48 dozen oranges, 140 bunches of bananas, 170 dozen eggs, 560 quarts of milk, and comparable quantities of carrots, apples, raisins, prunes, sugar, Zwieback, and the like. Nor can we neglect our monthly order of 500 frogs and 10 pounds of imported African ant-eggs.

As may be judged, our most expensive boarder is Lizzie, the four-ton elephant. Her daily menu, including 100 pounds of timothy hay, 10 quarts of crushed vegetables, and 16 quarts of oats and bran, costs approximately $2.60. But Lizzie more than pays her way, ranking as she does among the greatest attractions at the zoo and thus helping gate receipts.

The varied diet of Sultan or Fatima, our monster hippopotamuses, costs approximately the same. The daily menu of each includes twelve quarts of white potatoes, 20 quarts of oats and bran, 4 heads of cabbage, and 50 pounds of mixed hay. This happy pair, incidentally, actually contribute more toward their upkeep than does Lizzie. On five occasions, as has been said, Fatima has gladdened the hearts of the administration and of thousands of child visitors by presenting offspring to the zoo, and her youngsters were always great attractions.

The hay-eating animals include also many varieties of deer, moose, and antelope, the rhinoceros, and various others. They too receive crushed oats, cracked corn, and bran, with portions of chopped vegetables in the proportions on which each type thrives best. No definite rules can be rigidly followed, the diets changing from time to time in accordance with the growth and condition of each animal. Cleanliness, however, is always assured. No unconsumed food may remain in a cage, since it may spoil. No cracks or crevices where food can lodge and become sour are permitted. Strict adherence to these rules undoubtedly prevents much illness.

Bamboo, our baby gorilla, enjoys a carefully chosen diet, earlier described, which costs about $.75 a day. His cousins, Sultan and Marianne, the chimpanzees, each enjoy a not dissimilar diet, which is served to each as follows:

Breakfast—7.30 a.m.	2 oranges, 1 cup boiled rice, 2 eggs beaten up in glass of milk.
Luncheon—noon	5 or 6 bananas, 2½ glasses warm milk.
	1 slice rye bread, 2 oranges, 1½ glass warm milk.

To this are added such delicacies as prunes, figs, and grapes, when available. The menu of the younger specimens varies as follows :

7 a.m.	2 oranges, 6 bananas.
8	1 cup sweetened boiled rice, 1½ glass warm milk.
Noon	6 bananas, 1½ glass warm milk.
4 p.m.	1 piece white bread, 2 oranges, 1½ glass warm milk.

One tablespoonful lime-water is added to every feeding of milk. Salt to taste.

Maggie and our other adult orang-utangs thrive on much the same diet as the chimpanzees. Our younger specimens receive the following :

7.30 a.m.	1 cup sweetened boiled rice and 2 bananas.
9	1 raw egg in cup of warm milk.
Noon	1 cup warm milk.
3.30 p.m.	1 piece white bread and 1 egg in cup of warm milk.

Several days a week these animals are given boiled sweet potatoes, lettuce, or onions. A tablespoonful of lime-water is added to every cup of milk. Raw milk of the best grade is varied with a malted milk. The gibbon's morning meal consists of half an orange with boiled tapioca and rice and is served about 7.30 a.m. At 11 a.m. he receives a small piece of bread, and at 4 p.m. a banana, another serving of tapioca and rice, and a cup of milk with lime-water.

The smaller monkeys and baboons receive a different diet, varying, of course, with size. A chacma baboon weighing sixty pounds will receive, for example, a daily ration of twelve bananas or six apples, or from twelve to fifteen boiled sweet potatoes, with a cup of peanuts or a pan filled with boiled rice, while a small South American cebus monkey seems entirely satisfied on a diet of two bananas or apples, two sweet potatoes, and a much smaller quantity of rice.

A typical menu for small monkeys follows:

7 to 8 a.m.	Boiled rice, raw eggs, bread, a little whole corn and sunflower seed mixed half and half (quantity decreased in summer), a few onions, and a little lettuce. Eggs are eaten shell and all by some, but broken into a pan for the more delicate specimens. Eggs are not offered on Wednesdays or Sundays.
3.15 p.m.	Mondays, Thursdays, and Saturdays: Boiled sweet potatoes, salted.
"	Tuesdays and Fridays: Bananas.
"	Wednesdays and Sundays: Apples.

All specimens receive a few raw peanuts four afternoons a week, and water containing a little lime-water every afternoon. Small quantities of hay are put into each cage, as the monkeys enjoy picking out the seeds, which have good food value.

The carnivorous animals receive one meal daily. This consists of fresh horsemeat in quantities varying with the size of the specimens. If the ration is consumed quickly it is increased; if a little is left, the quantity is diminished. A large male lion will devour from twelve to fifteen pounds of meat, a large male tiger from nine to twelve pounds, a leopard two and a half pounds, and a puma about three pounds. All feline animals and hyenas receive two tablespoonfuls of cod-liver oil every fifth day. Lions, tigers, jaguars, leopards, and pumas receive also about one and a half pound of bone every other day. Soft bones which will not splinter when broken are preferred. Fresh liver is fed as a physic as needed.

Wolves and foxes get horsemeat daily and soft bone twice a week. Many foxes are given chicken heads twice a week instead of meat.

Bears are fed twice a day. Their diet consists of bread, fish twice weekly, and a little meat. In addition to this diet, Polar bears receive horse fat twice a week and suet more frequently. They also receive more fish than the other bears. Black bears are given apples, carrots, tomatoes, and sweet corn along with their bread, and a small quantity of fish.

The average cost of feeding lions and tigers on horse meat, as preferred at the Philadelphia Zoo, is about fifty cents a day each; and of bears about three dollars a week. The horsemeat is fresh from animals slain quickly, scientifically, and mercifully at the gardens. To-day the majority of these horses are purchased for approximately nineteen dollars apiece. Years ago this expense was much lower, because of gifts. Many wealthy familes whose carriage horses had outlived their usefulness sent them to us for a quick, painless death rather than sell them into unknown conditions. Department stores also made similar gifts before their deliveries were mechanized. At one time our greatest source of supply was the breweries.

The meat is dressed exactly like beef and cut into pieces of the proper size for each animal. The livers are used as laxatives when required, the intestines are given to the vultures, and the hearts are boiled, ground, and roasted to be mixed with a specially prepared food for soft-billed birds.

In fact, virtually every part of the horse is utilized.

The bread for the bears and others is made in our own bakery, which produces from two hundred and fifty to three hundred pounds daily. It contains molasses, bran, salt, yeast, and white and rye flour. Most of the animals which receive it, especially the bears, prefer it to any other kind of food placed in their cages.

Our daintiest eaters are, of course, the birds. Among them the ostrich is perhaps the most expensive, costing ten cents a day for his diet of chopped alfalfa, corn, bran, and chopped fruit and vegetables. On the whole, the feeding of birds is more complicated than in the case of mammals, particularly when a large and varied collection must be provided for. In our large bird cage, which contains more than one hundred different types, are placed twice a day two large dishes. The first contains a specially prepared food, to be later described, along with bananas, apples, canary and hemp seed, cracked corn, and wheat screenings. The second contains cut-up raw fish, bread, and ground meat. Thus every bird has opportunity to select its own food. The large flamingo which has been with us many years is perhaps the most general of all in his tastes. He eats a bit of everything, from fish to bananas.

Birds of this kind are often slow to feed after arrival, but soon become accustomed to their new surroundings and thrive on the above menu.

Our prepared food is of two kinds—a dry mixture for such birds as the bell birds, thrushes, hornbills, jays, birds of paradise, and small perching birds, and another, known as mocking-bird food, for such soft-billed birds as bulbuls, mynahs, tanagers, and others. The dry prepared food is made up by us in large quantities, but the ingredients can be reduced if the proper proportions are maintained. The recipe follows:

6 lbs.	fine bonemeal
37 lbs.	Zwieback (ground)
8 lbs.	white corn meal
5 lbs.	ground horse or ox heart.

When offered, this food is sprinkled with grated hard-boiled eggs, grated carrots, and white potatoes, boiled and ground. About eight pounds of potatoes, ten eggs, and five pounds of raw grated carrots are added to every seven pounds.

The so-called mocking-bird food contains:

12	lbs Zwieback
3	lbs. ground horse or ox heart
2½	lbs. white corn meal
5	lbs. best lard

The horse or ox heart is boiled, ground, roasted, and then ground again until it finally resembles ground coffee. The common ox heart of commerce I found sometimes contained fine splinters of bone, so for this reason we prepare horse heart as above described ourselves. To this food is added, when served, a small quantity of hard-boiled eggs, raw grated carrots, and ant-eggs, in about the proportion of seven eggs, a pound of carrots, and two ounces of ant-eggs to every two pounds of the preparation.

One of the most interesting diets is that prepared for the echidna, our egg-laying mammal from Australia. The Philadelphia Zoo holds the world's record for longevity of this species in captivity. Our specimen has lived here for more than twenty-six years on a daily diet consisting of one egg broken into a pan and one small cup of milk with a little lime-water in another pan. The animal is fed at dusk, when it creeps forth from the box where it has spent the entire, day to eat first from one pan and then the other. It will not eat if this food is mixed in the same pan, but seems to enjoy going slowly from one pan to the other, lapping up the contents by running its extremely long tongue around the edge and drawing the food quickly into its mouth. The cost of feeding the echidna averages six cents a day.

Often the problem of finding the correct diet for a new arrival offers serious difficulties. I had one such experience after we purchased a most expensive aard-wolf. It looked rather thin on arrival and was immediately offered a meal of meat. This it refused. Chicken heads, freshly killed pigeons, and, in fact, everything which we thought might tempt an animal with "wolf" in its name was offered without success. Five days passed, while the specimen continued its fast, and I continued to read whatever I could obtain on its habits. Somewhere I read that it frequently ate ants. I ordered the keeper to mix up some food similar to that given the ant-eaters. This consists of three eggs beaten into one pint of warm milk, to which is added a small quantity of finely ground meat. When the mixture was put in the aard-wolf's cage he eyed it for a while, then decided to investigate. Walking weakly the short distance to the pen, he smelled the mixture and, to our delight, thrust his tongue into it. We had struck the right food at last. From that time on, he has been eating regularly and is now a fat and healthy animal. To this food we have now added more of the ground meat and a teaspoonful of cod-liver oil.

This experience taught us never to give up trying to find the best food for any specimen, and to stick to that food when discovered. I do not believe that any amount of medicine could have helped the aard-wolf then. He was not sick, but starving for lack of the food to which he was accustomed. I learned also that an aard-wolf is not a true wolf, but in a class by itself, being the only one of the genus *Proteles*, and closely allied to the hyena, which to some degree it resembles.

Another important rule is never to give a caged animal more than it seems naturally inclined to eat. When animals are full of life and activity, clawing and pacing their cages at feeding-time, and, when fed, eating with relish, they are receiving the correct amount and the correct kind of food. If, however, they show little interest in their food, leaving large portions uneaten, and seem "pot-bellied", they are usually overfed. Such animals become lazy, uninteresting and, if heavy feeding continues, unwell. Some zoos feed only six days per week, the specimens fasting on Sundays. This does no harm, but since visitors enjoy watching the exhibits eat, it seems useless to deprive them of this interesting sight. In my opinion a better plan is to reduce slightly each animal's portion on Sundays.

The meals, when determined upon, are prepared with the care and cleanliness characteristic of the most expensive restaurant. Apart from the scientific balancing of necessary elements always insisted upon, a kitchen is available for special diets for those that appear to be unwell. The kitchens are under direct supervision of our medical and pathological staff, which, apart from two physicians of high standing, includes four pathologists, with necessary laboratory assistants.

All food, wherever prepared, is rigidly inspected before it enters the cages. Hay, for example, whether purchased in bales or loose, is carefully examined to see that it contains no foreign objects such as wire or nails. Vegetables, milk, eggs, lettuce, oranges, prunes, figs, grapes, and other foodstuffs must meet the same standards that any good housekeeper would demand. The tons of seeds of every variety purchased for the birds are passed through a blower to eliminate dust and dirt.

Obviously, it would be impossible here to tabulate all the separate menus of our 3,300 specimens. The diet varies for each species. As an example of this variety may be cited the accompanying list of different foods required for members of one order—the *Reptilia* :

Crocodiles and alligators.—Raw fish and raw meat in quantities according to the size of the animal.

Terrapins and turtles.—Raw meat, finely ground.

Tortoises.—Lettuce, cabbage, bananas, grass, water-melons, and such fruits and vegetables as they will eat.

Small lizards.—Flies, meal worms, roaches, or other live insects.

Large lizards.—Ground meat and bananas.

Monitors and taguixins.—Whole eggs, ground raw meat mixed with raw eggs.

Iguanas.—Blossoms of plants, lettuce, and other green foods.

Gila monster and Sonoran heloderm.—Raw eggs mixed with ground raw meat.

Pythons.—Whole pigs, chickens, rabbits, guinea-pigs and rats.

Boas and anacondas.—Same as pythons, with the exception of pigs.

Eryx.—Mice and small rats.

Water and garter snakes.—Frogs, toads, tadpoles, and small fish.

Ring-necked and DeKay's snakes.—Earthworms.

Hog-nosed snakes.—Toads.

Corn, chicken, Emery's mountain black, spotted mountain black, Lindheimer's all pine, milk, elegant bull, and all king snakes.—Mice, rats, or any small animals, alive or dead.

Purplish death adder.—Frogs.

Indian, Egyptian, and South African cobras.—Rats and mice, alive or dead.

Snake-eating cobra.—Live or dead snakes.

Harlequin snake.—Lizards or small snakes.

All vipers, puff-adders, copperheads, water moccasins, rattlesnakes, deadly snake, fer-de-lance, and bushmaster.—Rats, mice, rabbits, and guinea-pigs.

Large bull and spotted frogs.—Small frogs, toads, mice, and rats—alive.

Small frogs, toads, salamanders, and newts.—Live insects, worms (small), and mosquito larvæ. Newts and salamanders sometimes eat raw ground meat.

Amphiuma, hellbender, menobranchus, and siren.—Small fish, tadpoles, chopped fish, and meat.

Electric eels.—Live minnows.

If one multiplies this by the many different orders and species represented in any large modern zoological collection, he will soon realize the importance and the complexity of the feeding problem.

CHAPTER XVIII

A DAY AT THE ZOO

To feed, watch, and protect the thousands of specimens in our own or any other large zoological garden entails a great responsibility. The Philadelphia Zoo, for example, requires approximately seventy employees, including medical and office staffs and extra labourers. This list includes twenty keepers and one head keeper, three ticket sellers, seven special officers, a night watchman, a head gardener, and from six to sixteen labourers and janitors, depending largely on the season. Their compensation is comparable to that in other lines. The most characteristic of these workers are the keepers, who play the involved rôle of friend, nurse, waiter, and disciplinarian to the animals in their charge. Men with the proper qualifications for such work are not easy to find. The great majority of successful applicants are former country boys who developed a sympathy for and understanding of animals through their experience with cattle, dogs, and domestic fowls, and their observations of wild life in woods and fields. City-bred men—particularly those who rely on political influence for positions—seldom last through the three months' probationary period which precedes regular appointment as a keeper. Special officers, ticket sellers, and the like, however, have usually the urban background. Retired policemen and firemen, accustomed to crowds, prove most efficient in such positions.

Naturally the administration of such an enterprise involving so large a group of specimens and employees is complex. Perhaps I can present the clearest picture of the problems arising in such work by describing a typical day in the director's office, the nerve centre of the organization.

Arriving at my desk early, I will hear reports and requests immediately from two men—the head keeper and the head gardener. The keeper reports all the animals in excellent condition, except perhaps a deer that died overnight, and a valuable bird that is drooping. He is directed to send the carcass of the deer to the pathological laboratory for an autopsy and, in accordance with our inflexible rule, to disinfect the enclosure where death occurred. Causes of death thus studied add not only important information to reports given to science, but aid in our own understanding of the specimens in our care. The valuable aviary specimen—perhaps a bird of paradise—demands a visit. With a member of our medical staff I shall inspect it later, and between us we shall decide on the necessary treatment. Then I am told that the Japanese deer have increased so in number that other enclosures are necessary. This too will require personal inspection, after which methods of moving them safely must be arranged. The gardener asks authority to cut down some old trees in danger of falling and replace them with rarer specimens; for the modern zoological garden is often an arboretum as well. Perhaps he asks approval of a new design for the tulip bed, now ready for planting. This too must be studied for an early decision.

Meanwhile the keeper in charge of the lion house sends word that one of our big mammals is refusing food. This demands immediate attention to determine whether the specimen is ill or merely temperamental. The keeper in charge of the hippopotamuses may report that a new arrival may be expected at any time. Arrangements must be made to afford the mother the necessary seclusion.

During such conferences the telephone jangles frequently. A famous sculptor asks permission to model some fresh importation. This is granted, along with the promise of any further assistance in our power to give. A newspaper has heard hints of the interesting event expect in our hippopotamus house and wants the latest facts. It is promised immediate news of the arrival. An animal dealer sends in his card, and we confer for an hour or more on the possibility of some new acquisitions.

After the dealer's departure a student calls to ask for material for a thesis. All our information is made available to him. Our conversation is again interrupted by telephone calls. An agitated feminine voice assures me that a tarantula is at large in the owner's cellar. It is probably only a large and harmless spider, and the housewife is advised how to cope with the situation. A still younger feminine voice asks for the gift of a lion cub for a pet. This is gently refused. A boy calls to offer me a big wolf that he has found roaming the streets. A few questions reveal that the lad has walked off with someone's police dog. Then letters must be answered. There are letters from directors of other zoological gardens asking our experience in treating certain diseases of animals or offering to sell or trade specimens. There are purely administrative and business letters such as any commercial firm receives.

After disposing of the mail the customary inspection of the gardens must be made. Than this, no feature of zoological park administration is more important. Careful study and design are, of course, most necessary before any exhibit is established. I have seen zoos practically ruined in their early development because of a lack of proper knowledge and foresight on the part of those in charge. I have seen expensive buildings and cages erected with no thought for the comfort and health of the animals themselves, or of working and feeding facilities. Unsightly cages, bad drainage, and other mistakes often result from the want of properly trained men to direct the work. Particularly is this true where political influence steps in, for politics and zoos can never mix. To-day there exists a real demand for men trained in the understanding and care of animals, to assume direction of the increasing numbers of zoological exhibits thoughout the country.

After inspection, there are reports and bulletins to be written, conferences with members of the board of directors, and similar administrative duties, until the day, never long enough, comes to a close.

Naturally, many of the purely administrative duties are concerned with the income necessary to maintain so large and complex an establishment as a zoological garden. The source of income depends on the character of its organization, which varies in almost every city that boasts a zoo. The famous and scenically lovely two hundred and sixty-five acre National Zoological Park in Washington is financed entirely by national funds and managed through the Smithsonian Institution. Admission, of course, is free. The splendid three hundred acre New York Zoological Park, founded and directed by the New York Zoological Society, a scientific corporation, is financed largely out of municipal funds, and obtains the remainder of its income from gifts, dues, and admissions charged two days a week. Our own park, founded and controlled by another scientific group, the Zoological Society of Philadelphia, receives from the city at this time some $37,500 annually, and acquires the remaider of its income, which reached $229,000 last year, from admissions, restaurant and similar concessions, sale of guidebooks, membership fees, donations, and the like. Many of its most valuable donations, incidentally, are in the form of specimens rather than of money, although, like most zoos, our own is in constant need of funds for expansion and can make its exhibits just as significant and educational as actual income from gifts and other sources permits.

Abroad, similar differences prevail in the control of zoological parks. The famous gardens in Regent's Park, London, are controlled by the Zoological Society of London. The menagerie in the Jardin des Plantes in Paris is under the control of the museum authorities. The Tiergarten at Berlin belongs to a private company. The Zoological Gardens at Buenos Aires are municipally supported.

Admission incomes at exhibits in the United States and in Europe are, of course, greatest during the months of late spring, summer, and early autumn. Sundays are the peak days at the Philadelphia Zoo, with the long week-end over Labour Day easily leading. As many as 8,000 visitors may pass the gates on an early-September Sunday. A total of 5,000 is not unusual. But on a Sunday in January this may drop to 1,500, and on a midwinter weekday to only 100 or 200. When Bamboo first arrived we had tremendous crowds, reaching approximately 14,000 during each of his first two Sundays. The great majority of visitors pay admission, although 200,000 tickets are distributed free annually to schoolchildren and residents in charitable institutions. The annual total of visitors exceeds 600,000.

How, I have often been asked, should one plan his visit to a zoological park in order to obtain the maximum of information and enjoyment. Directions are rather simple and easy to follow.

First, I am convinced the visit should be made in a spirit of sympathetic interest. Don't look at the specimens as a source of amusement, but rather as fellow inhabitants of this planet whose physical and mental characteristics happen to be different from ours, but nevertheless fascinating and informative to observe.

Second, when you do attend a zoo be prepared to make a complete and leisurely visit. A few minutes' inspection of the lions and tigers, the monkeys and the elephants is not enough. Many other animals, though not so popular, are equally fascinating to watch after one knows them. To me the most interesting exhibits are in the reptile house. The gorgeous colouring and sinuous movements of many of these specimens are quite beautiful. Yet, despite the interest that these and other specimens offer, I often see parents dragging absolutely fascinated youngsters away after a few minutes of inspection, with the warning : "Come on, children ; we can't waste any more time here." This, it seems to me, is unfair to the youngsters, with minds eager for knowledge, and to the collection, whose primary purpose is educational.

Third, plan your tour of inspection so as to bring you into as many of the various houses as possible at feeding-time. Even the most lethargic of beasts show animation then. This plan offers also the opportunity to observe animals at a time when they are absolutely natural. That is always more interesting than watching them at artificial tricks taught by showmen. Under such conditions you are not seeing animal habits at all, but merely a reflection of what some man has thought might prove profitable. The schedule of feeding hours can always be obtained at the entrance of a well-conducted zoological park.

Fourth, while watching the specimens, refrain from any sudden gesture, whether intended to intimidate or to encourage. Wild animals watch and distrust all movement, except, of course, on the part of their recognized keepers. One can talk, however, without troubling them. Usually they make no response to an unfamiliar voice, whether directed at them or at others in the party of visitors.

Fifth, don't let a feeling of pity for the specimens fog all your impressions. The great majority of animals in captivity in any well-regulated zoo are better fed, better protected, and live longer than in their native state, where a diminished food supply may mean lingering death, or the first signs of failing physical power bring death either from beasts of prey or from their own kind.

Although our knowledge of animal psychology is still limited and inexact, my own impression is that animals are not necessarily unhappy in such humane and scientifically directed captivity as zoological parks provide. I say this not only as their guardian but as their friend.

CHAPTER XIX

PETS AND THEIR CARE

THIS chapter is for those who love pets and who want to assure their health and happiness. The proper care of pets offers, in my opinion, opportunity for some of the most valuable lessons any child can learn, quickening as it does his interest in the fascinating science of zoology and at the same time developing a spirit of kindness and sympathy.

So many different varieties of animals have been domesticated that it would obviously be impossible to discuss them all here. For that reason I shall mention the more common types.

Monkeys are popular as pets in various parts of the world. To my mind the species best adapted for the purpose is the woolly monkey of South America. This animal, especially when young, is docile and affectionate. The cebus or ring-tailed monkey, also of South America, is also attractive and easy to obtain, although all animals, like humans, have their individual temperaments. The young of many species of monkeys are interesting and gentle, but with increasing years may develop ugly dispositions.

Most species of small monkeys are natives of the warmer countries and unable to withstand our winters. Therefore, provision must be made to keep them in heated quarters during cold weather. A temperature of from sixty to seventy degrees with plenty of fresh air but away from all draughts is best. In warm weather they are happier out of doors, since sunshine and fresh air are necessary to good health. Sanitary conditions and good, clean food must be assured.

A small pet monkey should have a cage approximating four feet square in which are hung ropes and swings for exercise. A small sleeping-box is also necessary. The bottom of the cage should be covered with sawdust or hay. Hay is usually preferable, as the monkeys will amuse themselves picking it over for the tiny seeds they enjoy. In general, the food of monkeys, while it varies considerably in the wild state, should be similar to that served on one's own table. Caution must be exercised, however, to see that they do not over-eat. A regular diet rigidly adhered to is always helpful.

The following is excellent for all small animals of this type:

At morning an egg-sized lump of boiled rice, a bit of bread, raw eggs, whole corn and sunflower seeds mixed half and half, a little lettuce, and (once a week) a few raw onions. This may be varied from day to day, omitting on occasion some of the foods. Raw eggs, for example, may be given about five days a week. In the afternoon, boiled sweet potatoes, salted a bit, three days a week; bananas two days; and apples two days. All monkeys may be given a few raw peanuts four afternoons a week and should receive drinking-water containing a little lime-water every afternoon. The water should be removed immediately after the animal has quenched its thirst. The diet can be varied also with a bit of cooked chicken, or cabbage when lettuce is not available. Fruits, cooked tomatoes, jam, and other titbits can be given in small quantities from time to time.

The howler monkey of South America makes an interesting pet but is very difficult to keep in captivity. It must be fed carefully on such foods as lettuce, white bread soaked in milk, three of four tablespoonfuls of condensed milk in a cup of water, bananas and apples, offered twice daily. Careful feeding on a balanced diet with sufficient fresh air and sunshine often prolongs the lives of even rare monkey pets for many years. One brown cebus was presented to the Philadelphia Zoological Garden by an owner who had kept it as a pet for twenty-eight years.

When monkeys become ill, their ailments are almost indentical with those of human beings, and much the same treatment is required. Slight attacks of indigestion can often be overcome with castor oil or the feeding of stewed prunes or figs. In the zoo, we have also used a preparation known as Carter's tea, which many monkeys and apes accept readily. Sometimes the animals can be treated without handling, but in most cases it is necessary to hold them while the medicine is administered. All small monkeys are easily caught if the hands are protected with thick gloves or inserted in the sleeve of an old coat. They should be gripped by the neck, from behind. After the medicine has been swallowed, the animal should be patted a bit, then put quietly back into its cage. It soon forgets the harsh treatment.

Colds also are treated as with humans. After a very small dose of laxative, the throat, nose, and chest are rubbed with camphorated oil and the animal is confined to a warm place. Such measures, however, should seldom prove necessary. Feed your pet carefully, keep it out of draughts, do not needlessly expose it to disease, and nature will usually assure its health.

Other monkeys frequently kept as pets include the rhesus macaque, the grivet, the marmoset, and the squirrel monkey. The first of these is a native of India. Although bright and affectionate when young, it frequently develops into a treacherous adult.

The grivet monkey of North-east Africa is docile, tractable, and shows much intelligence in captivity, but is rather difficult to obtain. Another species of this type fairly common among animal dealers is the green monkey of West Africa. It is active and intelligent, and when young has a cheerful disposition, but loses these charms with age.

The marmoset is a small animal covered with thick silky fur, and is gentle and playful. It requires, however, the best of care and attention, as it is most susceptible to cold. I know of one marmoset that was wrapped in a flannel blanket and placed in a felt bag whenever taken out of doors in winter. It lived several years.

The common squirrel monkey, with its large bright eyes, gentle manners, and attractive baby-like face, also makes a pleasant pet if properly treated.

All monkeys dislike handling. It is better, therefore, to let them have their own way whenever possible and to coax rather than drive them.

The most common of pets—cats and dogs—are members of the same order of *Carnivora* as lions and tigers. The cat is less demonstrative than the dog, but if well trained can become a most valuable and affectionate friend.

The differences in breeds of domestic cats are comparatively slight. Black cats are remarkable for their clear yellow eyes. White cats sometimes have blue eyes. Often, however, the eyes of white cats differ ; one may be blue and the other yellow.

In my opinion, the most beautiful of all cats are the Angoras or Persians, with their long and fluffy fur and their gentle dispositions. The Maltese and common tabby both make good pets.

Like all carnivorous animals, domestic cats should be given meat, either raw or cooked. They also enjoy fish, but this may be given only in very small quantities. Bread and milk are favourites among them and are particularly good for kittens, which should receive no fish or meat. Cats are generally cleanly in the habits and can easily be taught to use a box filled with sawdust or sand, which should be changed frequently. For the birth of their young, cats seek secluded places, usually dark corners, a natural instinct with all animals. Until about ten days old, the eyes of kittens are closed. They should remain in a darkened room for at least several days after the eyes open, as sudden exposure to strong light may result in blindness. If a good home cannot be arranged for a litter of kittens, they should be mercifully destroyed at birth, permitting one or two to remain with the mother for at least five or six weeks for her health and comfort.

At times cats are afflicted with worms. A dose of santonin (one grain for a full-grown cat), followed in eight or ten hours with a tablespoonful of milk of magnesia, is an effective remedy.

Stray cats are a great menace to wild birds and animal life. Under no circumstances should one be left to shift for itself. If no owners can be found, such cats should be mercifully slain, in kindness to both the cat and its natural prey.

Dogs, although they belong to the order *Carnivora*, have lived so long with humans that they will readily eat bread, cereals, potatoes, and similar foods. They should, however, receive a certain quantity of meat, preferably cooked. I have found stew consisting of fresh meat thoroughly cooked and stirred into a porridge made from yellow corn meal an excellent diet when given twice a day with the addition of a few dog-biscuits and occasional bones.

No dog should be given food at meal-times from the table. In this, among other things, its training should begin at an early age; not by whipping, but by carefully and thoroughly impressing upon it the idea of what is wanted and the necessity of obedience. Although this method may seem tedious, it will ultimately succeed. The whip may be used sparingly when the animal understands why it is being punished. Titbits of food and words of praise should reward obedience. Both help greatly in training animals.

Large, husky dogs live out of doors throughout the year in a fairly cold climate. In such cases, kennels sufficiently large to protect them from rain and draughts must be provided. The kennels should also be kept clean and sanitary, and constructed in such a manner that the tops or sides can be removed for scrubbing. Heavy floors, several inches from the ground, covered with hay or straw for bedding, are also necessary. Daily exercise of some sort is imperative.

The dog of medium size should have its own place in the shed or cellar with plenty of straw or a blanket to lie on. Poodles and other small delicate dogs need boxes or baskets in warm rooms. They are usually able to stand but little cold, and even the temperature of the house on a cold winter's night may be too low for them. All dogs must be washed frequently in tepid water with an antiseptic soap. Tar soap is splendid, and leaves a clean, pleasant odour. After washing, a dog should be wiped dry and kept out of the cold air for several hours. The hair should be brushed or combed at regular intervals.

Dogs are subject to few diseases, the most dreaded of which is hydrophobia. Fortunately this is not common. When an animal shows the first symptoms of the disease—extreme thirst, fear of water, frothing at the mouth, radical changes of disposition, and the like—it should be confined while a veterinarian is summoned. Frequently dogs are affected with worms. The symptoms include dragging the hindquarters along the ground, biting itself because of severe itching, etc. This trouble can be readily overcome by a few doses of areca nut or some other good vermifuge, obtainable from pet dealers.

The family of rodents, too, has supplied many common pets. Among them are the guinea-pigs, or cavies, which are popular, though usually too stupid to show affection for their owners. They may be handled with impunity by children. There are many varieties of these animals, ranging from the Angora with its beautiful long hair to the common guinea-pig with its great variety of patterns and colours. They breed rapidly and require, therefore, large boxes or cages. A box four feet wide, six feet long, and two feet high easily accommodates twenty-five of them. The foods upon which guinea-pigs thrive are stale bread, beets, apples, carrots, and lettuce or cabbage in small quantities. They should also have clover hay in their boxes. If vegetables are fed, water is unnecessary. Care must be taken not to crowd too many males together, or frequent and sometimes fatal fights will ensue.

Rabbits are among the most popular pets with very young children. They may be obtained in many beautiful varieties. Their cages should be about four feet wide, six feet long, and two feet high, assuring room for one male and two females, as they are usually happier in trios rather than in pairs. All rabbits breed readily in captivity. The most healthy diet for them consists of stale bread, carrots, apples, beets, and a good quantity of clover hay. Cabbage or lettuce may also be given, but these foods should be offered carefully and in small proportions to avoid dysentery. No water is required except when the food consists exclusively of hay and grain. Cages must be kept dry and clean at all times. Nesting-boxes about twelve by eighteen inches and about one foot high should be placed inside. Like virtually all other animals, rabbits like to hide their nests in dark corners.

Although many persons, particularly women, fear the small, unobtrusive mouse, I can assure you that white mice make interesting pets. If these animals are kept, small cages, covered on at least three sides with wire-netting, are necessary. Several small nesting-boxes about six inches square should be placed inside each cage and supplied with soft hay, newspaper, or some other soft material. The floors should be sprinkled with sawdust to absorb the moisture. Food for white mice consists of bread soaked in milk and a grain ration made up as follows:

20	parts	crushed oats
10	„	buckwheat
5	„	cracked corn
5	„	whole wheat
2½	„	sunflower seed
1½	„	millet
1	„	peanuts

In addition lettuce and fresh water should be given daily. Like guinea-pigs, white mice should not be crowded.

White rats can be housed together in greater numbers, or they may be kept in pairs in small enclosures covered with wire-netting. If one cares to breed them, a cage three feet long, four feet wide, and two feet high is large enough to hold twenty-five. Several nesting-boxes about eight inches wide, ten inches long, and eight inches high should be arranged along one side and supplied with nesting-material. The food is the same as suggested for white mice.

Many less common, though no less interesting, pets have been domesticated by animal lovers—among them the raccoon, the woodchuck, the badger, the otter, and that rare little mammal the kinkajou. Raccoons, when young, can become very affectionate playfellows. I have seen specimens so tame that they followed their masters like dogs and would come even from the tops of trees in response to a whistle. They are easy to care for, living out of doors during the entire year. Their food consists of a little raw meat, bread, green corn, and tomatoes when obtainable, and a little fresh fish about twice a week. Pools of fresh water are necessary to their comfort, as all are good swimmers and have the habit of washing their food before eating.

Woodchucks, too, can become most affectionate if caught young and tamed. Unfortunately, these animals are so persistently hunted by farmers, who consider them pests, that the majority are wild and wary. Because of their habit of living under the ground, care must be exercised to have their enclosures arranged so that they will be unable to dig out. If permitted to stay out of doors during winter, plenty of hay should be supplied for them. With it they will make underground nests and hibernate, but if kept indoors and properly fed they forgo this habit. Very young specimens may be fed on bread and milk or cooked oatmeal. When older they are given raw vegetables.

Like the woodchuck, the badger must be captured young to make an agreeable pet. This animal is so vigorous a digger that a cement-bottomed cage is almost necessary to retain it. Bread and ground meat constitute its diet.

Otters make interesting pets. They are playful and learn readily, and if captured young enough can be taught many amusing tricks. They spend much time in the water, and should therefore have a tank in which to swim and play. In the wild their favourite pastime is the building of slides, down which they plunge into the water. Their food, in captivity, consists entirely of fish, fed twice daily. If the otters are kept out of doors throughout the year, their ponds should never be allowed to freeze entirely over.

The kinkajou is one of the few animals of its type with a prehensile tail by which it can suspend itself. I have often observed one in the zoo hanging by its tail on the topmost bars of the cage while eating food held in its front paw. These animals are gentle and affectionate, and enjoy being fondled. Their habitat is the forests of South America. All have non-retractile claws, rounded heads, cat-like feet, and extremely long tongues. In captivity they thrive on a diet of bananas and apples, with a little ground meat and a raw egg twice a week. They must be kept in warm places during the cold weather.

And now we come to the loveliest of all pets—

the birds. Always cheerful and happy, they have many points in their favour. As a general rule all birds are easy to feed and care for. By far the most popular, however, are the canaries, not only because of their song, but because they are so trouble-free.

The majority of canaries in this country are bred in captivity. Many thousands are imported annually from Germany. The male is in greatest demand, since it has the brightest plumage and the loveliest song. Like most other birds, canaries differ greatly in temperaments and in intelligence, but almost all are quick and bright. One, which I owned myself, performed almost a watchdog's duties, chirping a warning after any unusual sound. Canaries quickly learn to recognize and love their masters, and ask in return only proper care. When ill, their ailments can be traced usually to one of four causes: draughts, improper food, neglect, and accident—all due to the owner's carelessness. Fresh air is excellent for all birds, but it should be warm and should not blow directly on them. For this reason is is unwise to hang a cage in a window except in warm weather.

One of the most interesting pets possible to own is the whistling bullfinch. These birds are beautiful in colour, with blue-grey backs, black wing-tips and tails, and even blacker caps. The sides of their heads and breasts are a wonderful light salmon pink. Their bills are thick and heavy. Their most charming feature, however, is the ability to whistle tunes. I have one now which includes two German songs, "*Blau Blueht das Blumenlein*" and "*Hinaus in die Ferne*", in its repertoire. These birds thrive on rape seed with three seeds of hemp added daily. Sometimes a little canary seed may be offered if they appear dissatisfied with their customary food. These birds can be trained only when very young. They are often placed in cobblers' shops in Germany, where they pick up a tune as the cobbler whistles it again and again while at his work. Well-trained birds bring from $50 to $75, but untrained specimens can be acquired for $5 or $6 each.

The shama thrush is another pet with a sweet, warbling song. These birds, like most of the tanagers, troupials, barbets, and mynahs, are fed daily on mocking-bird food, a few meal worms, a very small quantity of ground meat, and small pieces of banana and apple.

The birds known as mynahs, as well as many of the finches and weavers, also make attractive pets. Some have excellent songs, and most of them are easily kept and tamed. Their food consists of canary seed, white millet, and fine millet mixed. Oat sprouts are also excellent. These are easily grown by placing oats in a large pan containing about an inch of water, in which they sprout and grow together to form a loose sod. Pieces of this sod placed in the cages from time to time will add greatly to the health of the birds.

Parrots, because of their ability to talk, make interesting but rather noisy pets. Among the best talkers are the grey parrots of Africa. They soon become tame and easy to handle, but careful attention must be given to the diet, as they are not, as a rule, long-lived. Their food consists of sunflower, canary, and hemp seed and bits of biscuit.

Lovebirds, of which there are many varieties, also make affectionate pets, but neither talk nor sing. Their food consists of canary seed, white millet, apple, bananas, and sugar corn in season. Peppers and lettuce in small quantities may also be given once a week. Like other diets herein mentioned, this has proved effective in the Philadelphia Zoo for many years and can therefore be recommended.

Gold and tropical fish also make beautiful pets. The breeding of goldfish began hundreds of years ago in China, where many different varieties were developed from the humble carp. Among the most remarkable is the celestial, so named because it gazes constantly at the sky. The eyes are of the telescope type, extending from the sides of the head with the pupils turned inward.

Goldfish may be kept in two ways. The common method is in a small bowl whose water is changed frequently to provide the necessary oxygen. A better method involves the use of the balanced aquarium. This requires a large tank providing a gallon of water for each full-grown fish, and sufficient aquatic plant life to produce oxygen and consume the carbon dioxide.

A well-balanced aquarium may be assured by the following means: wash the aquarium thoroughly, place about two inches of clean white sand or gravel on the bottom, then fill half-way with clean water and plant therein plenty of such aquatics as *Anacharis, Sagittaria,* or *Vallisneria.* Other plants seem attractive, but may have objectionable features. Several become ragged-looking; *Ludwigia,* for instance, loses its leaves. The best way is to fill the corners or entire side of the tank nearest the light. Rock-work will help the general appearance and hold the plants in the sand. Rocks with many small holes should be avoided, as dirt may accumulate in them and foul the water. This applies also to shells and other ornaments. After planting, the tank should be filled with water and placed in its permanent position. After a few days the fish may be added, with perhaps a small snail or two to keep the water and glass clean. The fish should be fed once a day, and the excrement should be siphoned from the bottom. Most commercial fish foods are satisfactory, but none may be fed in excess, as unconsumed food will foul the water.

Tropical or exotic fish are very easily kept and breed well in captivity. Their home is prepared exactly as is the balanced aquarium for goldfish, but requires, in addition, some floating plants and a glass covering. The grains of their food should be smaller than in the case of goldfish. Most varieties require temperatures of sixty-five degrees or more and must be kept particularly warm when breeding.

Among the most common of tropical fish is the little guppi from Venezuela. The males are resplendent in colour, but the females are plain. They bear their young alive. When born, the young hide in the floating plants in the surface until strong enough to escape their voracious parents, who try to eat them. A large tank can contain many varieties of small live-bearing and egg-laying tropical fish, all living together in apparent happiness.

Of the egg-laying tropical fishes, the paradise is best known. These are pugnacious little creatures and can endure lower temperatures than the average tropical. Their breeding habits are most peculiar. The male first forms a nest of bubbles among the floating plants. Then when the female lays he picks the minute eggs off the bottom and shoots them from his mouth into the bubble nest, where they hatch quickly. If any of these eggs fall out of the nest they are retrieved by the male, who also cares for the young after they are able to swim. In addition to these many duties he maintains a careful watch over the female to keep her from eating the eggs.

Among other interesting varieties of exotic fish are the mouth-breeders, which harbour the young in their mouths when danger threatens; the chanchitos, which build nests on the bottom; and the splashing salmlets, which lay their eggs on the stalks of plants above the water-line and splash them until they hatch.

The feeding of the various species is very simple and may be learned from the dealer or by purchasing any one of the many small books on the subject.

THE END

APPENDIX

THE NEWER TREATMENT OF SNAKE-BITE POISON IN THE UNITED STATES

THE Antivenin Institute of America, a division of the H. K. Mulford Company, of Philadelphia, prepares serums for use in cases of rattlenake bite. It has several distributing station in the United States. The directions below are from the Institute's Bulletin Vol. 3, No. 2, of July 1929.

For the Victim—What to Do When Bitten

1. Apply a ligature or tourniquet a few inches above the bite. For this purpose use a rubber garter, a piece of small rubber tubing, a handkerchief, cord, or even a shoe-string. Do not bind the limb too tightly, but just tightly enough to retard the circulation returning through the veins toward the heart. The sole object of the tourniquet is to delay absorption of the poison into the general circulation, but if it is applied too tightly or kept on too long, gangrene is likely to set in, with resulting destruction of the flesh in the affected area. It is important, therefore, to release the tourniquet every 10 or 15 minutes for about a minute at a time.

2. If you have Antivenin with you, read carefully the directions on how to prepare the syringe and how to make

the injection. Remember the venoms of North American snakes are usually slow in acting. Do not allow fear or agitation to make you overlook important points.

3. When the syringe has been made ready, proceed at once to inject the entire contents of the syringe under the skin.

4. The tourniquet should then be released.

5. If the bite has been inflicted by a large snake, particularly by the Texas rattler or the Florida rattler, and if the symptoms are severe and develop rapidly, the Antivenin treatment should be supplemented by incision and suction.

Other First-aid Measures

6. If Antivenin is not at hand, there are only two other first-aid measures that have proved of value. These are incision and suction, both of which have been used in Texas in cases of bites inflicted by the Western diamond-back rattlesnake. Make a cross-cut incision at each fang-mark. For this purpose use a sharp, clean knife or razor-blade, and make the cut all the way through the skin, that is, about ¼ of an inch deep and 1 inch long. This allows some of the poisonous fluids to escape.

The removal of toxic fluids may be increased by applying strong suction over these incisions. The suction may be done mechanically if some apparatus, such as a breast pump, is at hand. Suction should be continued for 20 minutes out of each hour over a period of fifteen hours.

7. In any case obtain the best medical attention as soon as possible.

Don'ts

Don't run or get overheated. Don't take any alcoholic stimulants. Circulation, increased by exercise or by alcohol, serves to distribute the poison much more rapidly through the body. Don't injure the tissues by injecting potassium permanganate, which is now known to be of no value as an antidote. Don't depend upon snake-bite "cures" or home remedies commonly used. They are of no value. Don't cauterize the site of the bite with strong acids or the like.

For the Physician. Special Directions

If the victim has not received an injection of Antivenin, it is important to inject the contents of one syringe as soon as possible. At the same time, release the tourniquet, if one has been applied. Repeat the injection every one or two hours unless and until symptoms are markedly diminished. In order to hasten the absorption of the serum, intermuscular injections are advised, and, in severe cases and those seen late, intravenous injection is recommended. In small children, when intravenous injection is difficult, the Antivenin may be given intraperitoneally. In shocked cases, physiological salt solution intravenously and blood transfusion are supplementary measures of life-saving value. For weak pulse and threatening heart failure give caffeine or strychnine. If incisions have been made at the site of the bite, the wound should be irrigated with one or two per cent salt solution (not normal saline). The application of strong suction may be continued over these incisions if the symptoms and condition of the patient indicate the necessity of hastening the treatment. Otherwise, apply a hot application of 1:10,000 mercury bichloride or a strong magnesium sulphate solution.

Extra Precautions

It sometimes happens that after the first shock and reaction has passed, the patient will show marked improvement. Some fatalities from snake-bite are plainly caused by an undue sense of security, following the observation that most patients do well for the first fifteen hours. Even though the general symptoms may be mild, it is important to keep the patient under close observation for at least twenty-four hours, and active treatment should be continued as long as the swelling is progressing. Repeat the injection of Antivenin every one or two hours, if the swelling is increasing. The danger is always in under-treatment rather than over-treatment. In treatment of snake-bite in children it is important to double the initial adult's dosage. The reason for this is that a mathematical relation exists between the weight of the body and the amount of the venom which it can normally neutralize and dispose of without serious injury, although the amount injected by the snake is approximately the same. The smaller and lighter the body of the victim, the less venom it can withstand, and the greater the excess of venom over the normal body resistance. Therefore, if the victim be a young child, there is much more venom requiring neutralization by the serum.

Serums used in the event of cobra bites are not manufactured in America. They may be obtained from the Pasteur Institute of Paris, France, or from Burroughs, Wellcome & Company, of London, Bombay, and Singapore. Most of the serums are included in regular outfits containing all necessary instruments and instructions for treatment.